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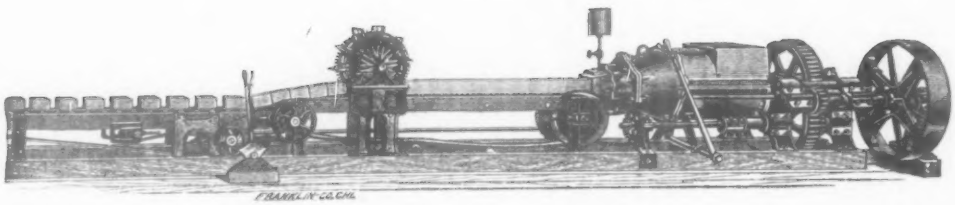

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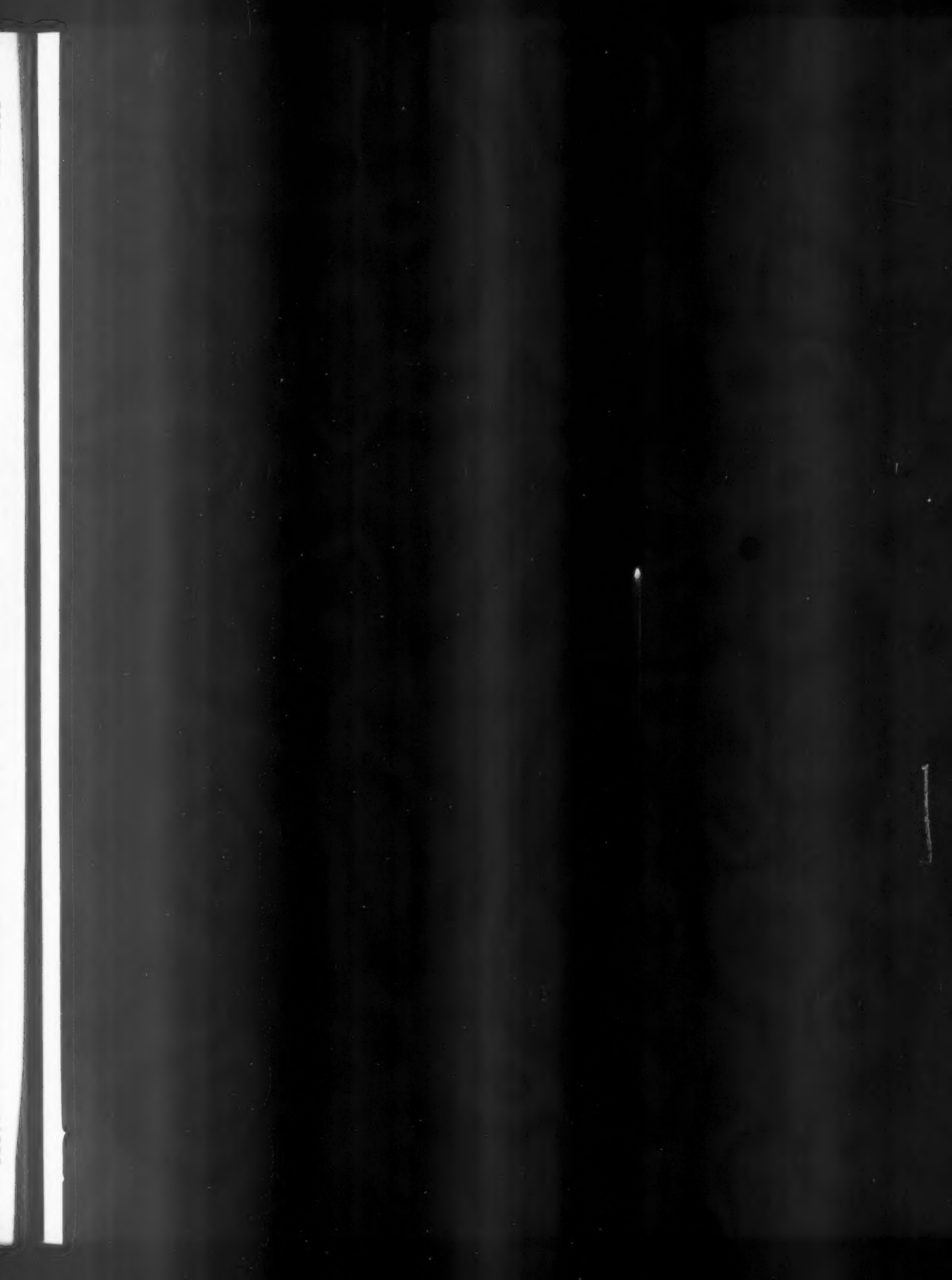


Paving and Municipal Engineering

VOLUME X. JANUARY, EIGHTEEN NINETY-SIX. NUMBER 1.

A MUNICIPAL TESTING LABORATORY.

By A. D. Thompson, City Engineer of Peoria.

PEORIA, Illinois, claims to be the first city in the United States to equip and operate a thorough and complete testing laboratory. So far as known, no other city in the country had at the time this laboratory was equipped, or has now, a laboratory owned and operated by the municipality, where all tests may be made upon cement, brick, iron, wood or other structural materials.

In June, 1893, Mr. Jacob A. Harman was appointed city engineer, and one of his first efforts was to procure for the city a plant for testing the materials used in paving and sewer work. The extremely poor results obtained in the past in municipal work caused the authorities to consider the suggestion favorably, and on October 3d a resolution was passed by the city council authorizing the commissioner of public works and city engineer to investigate and report to the council "the expense of suitable machinery for testing the quality of cement and brick to be used on public works." This report was submitted, and on November 7, 1893, the city council appropriated $1,208 for the above purpose, and authorized the department of public works to make the purchases recommended in their report.

Under this authority the laboratory was fitted with a Riehle vertical transverse tension and compression screw power testing machine of 100,000 pounds capacity, a Riehle 2,000-pound cement testing machine and a full complement of sieves, scales and weights for cement tests. For the abrasion test on brick, a cast-iron rattler was made two feet in diameter and three feet long, and vats were placed for making the absorption test. The power for operating the machinery was furnished by a 12-inch Pelton water motor. The

city was fortunate in procuring this machinery during the World's Fair at Chicago, and by contracting for the tension and compression machine and cement machine which the Riehle company had on exhibition at Chicago, these machines were procured at a very much reduced price. The total cost of the laboratory, completely fitted, may be itemized as follows:

100,000 pound screw power testing machine and one 2,000 pound cement tester	$900 00
Freight and hauling on machine	14 25
Canvas cover for same	5 00
Foundry rattler	70 00
Canvas cover for same	6 90
Encasing rattler	18 65
One set cement test wires	4 75
One four-gang mold	10 00
Brass molds	20 00
One set cement sieves	6 75
One special scale for fineness	12 50
One dozen cans	1 00
One set sand sieves	5 75
One grocer's scale	16 25
One Pelton water motor	60 00
Wiring, etc., for electric lights in testing room	9 75
Plumbing in testing room	19 12
Shafting	15 17
Pulleys and belting	42 36
One small ladder	2 25
Labor setting up machinery, cleaning machines, etc	15 05
Bolts, lumber and miscellaneous supplies	20 00
Total	$1,275 50

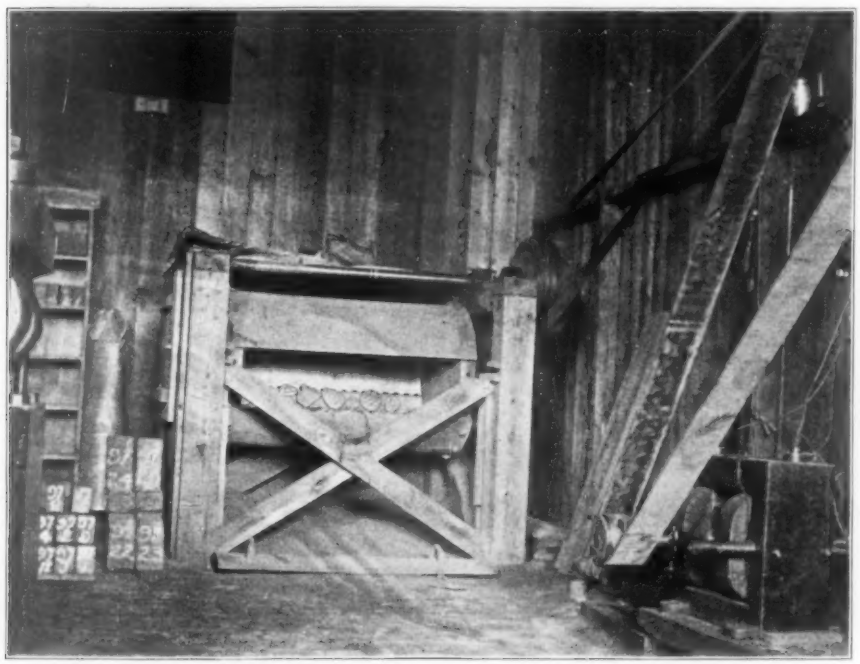
In the latter part of April, 1894, the laboratory was put in operation by the writer, who began a series of tests upon paving blocks, 3x4x9 inches, and paving bricks, 2½x4x8 inches, to determine the relative qualities of each, and also to obtain *data* upon which to base the specification requirements for the ensuing year. As a result of these tests the paving blocks, which had been almost exclusively used previous to 1894, were prohibited in future work. Since that time all material used on any public improvement has been tested before being placed in the work, and this plan has proved eminently satisfactory to contractors, citizens and officials in charge of the work.

The accompanying tables, marked Nos. 1 to 7, inclusive, give the results of the tests upon paving bricks and cement during the

season of 1894. The results of tests upon the large blocks can not be fairly compared with those of the small bricks, as the same loss in each will show a much smaller percentage in the block, due to its greater mass, which is fifty per cent. more than that of the small brick.

METHOD OF TESTING BRICK.

The samples of bricks for making the tests are procured by the city tester, from the material delivered along the line of the work.



RATTLER FOR ABRASION TEST.

Preliminary tests upon samples submitted by the contractor are generally made before the bricks are purchased, but this test does not bind the city in any manner, and is simply made as a guide for the contractor in purchasing brick. All bricks to be used in paving work are subjected to the three tests of abrasion, absorption and transverse strength. The number of samples obtained depends upon the uniformity and quality of the lot. During the past season we have in general obtained one lot of twenty-four

TABLE I.

SMALL BRICK TESTS—

SIZE, 2¼ X4X8 IN

On	From	To	Lot No.	Manufacturer.	Absorption, Per Cent—48 hrs.				Modulus of Rupture.				Abrasion, Per Cent—1 hr.			
					No. tested.	Highest.	Lowest.	Average.	No. tested.	Highest.	Lowest.	Average.	No. tested.	Highest.	Lowest.	Average.
	Samples		3	Spurck Paving Brick Co	4	3 19	2.47	2.90	5	2639	958	1989	5	9.82	6.70	7.65
	"		4										3	8.70	7.28	7.99
	"		5	St. Louis Press Brick Co	5	1 63	0.51	1 08	6	3691	1650	2616	6	12.63	9.10	10.92
Jefferson	Main	Franklin	6	Springfield Paving Brick Co.	5	1 64	0.00	1.07	5	2862	2357	2583	5	14.30	10.22	12.59
	Sewer Brick		8	Spurck Paving Brick Co	6	5.78	5.03	5.30	7	2158	1027	1722	7	11.26	3.55	6.12
	Samples		9		5	10.22	3.46	7.47	5	1830	1231	1543				
	"		10	Grape Creek Clay Works	9	4.48	0.57	1.66	6	2727	1471	1908	4	12 43	9.77	11.16
	"		11	Galesburg Brick and Terra Cotta Co	5	5.90	0.59	3.14	4	3510	1907	2818	4	7.95	5.38	6.59
	"		12	Wabash Clay Co	2	2.50	1.96	2.23	2	2018	1817	1949	3	12 31	6.80	9.28
	"		14	Leaman Clay Co	3	1.15	0.77	1.01	2	1135	827	981	2			11.19
	"		15	Ottawa Fire Clay and Brick Co	3	3.32	2.34	2.95					3	8.94	5.71	7.06
	"		16	Streator	2	5.56	5.56	5.56					2	18.55	2 22	7.66
	"		17	Ohio	2	3.63	1.42	2.53	2	2239	2019	2123				
	"		18	Central City Brick and Tile Co	2	4.23	4.15	4.19	1			2184	5	19.35	4.49	8.05
	"		19	Pioneer Paving Brick Co	1			5.59	1			1743				
	"		20	Wabash Clay Co	4	4.20	0.58	1.69	2	2329	2230	2279	2	8.34	6.96	7.65
	"		22	Ottawa Paving Brick Co	4	5.44	2.88	4.15					3	19.90	14.50	17.10
	"		23	Uhrichsville Fire Clay Co	1			4.96	1			1278	1			13.25
	"		24	Abingdon Brick and Tile Co	4	9.93	0.00	3.70					4	13.90	6.38	11.44
	"		26	St. Louis Press Brick Co	6	1.56	0.40	0.27	2	3199	3116	3157	4	11 21	9.00	9.79
	"		31	Springfield Paving Brick Co	1			1.70	7	33 4	2805	3015	4	10.81	8.80	9.40
	"		32	"	1			2.14	1			3496	3	9.92	8.92	9.45
Alley Bl'k 6	Main	Fulton	35	Purington Paving Brick Co	9	4.26	0.50	2.39	10	3375	2477	2893	10	5.60	5.00	5.70
" "	Samples	"	36	Spurck Paving Brick Co	6	5.00	1.50	3.46	6	2572	510	1427	6	8.00	5.00	6.06
Alley Bl'k 12	Fulton	Liberty	39	Purington Paving Brick Co	19	2.19	0.00	0.90	10	3125	2301	2667	9	6.60	5.10	4.76
" " 18	Fayette	Eaton	40	" " " "	19	1.10	0.00	0.54	10	3815	1260	3072	1	7.50	4.30	5.91
Main	Adams	Washington	41	" " " "	20	2.50	0.60	1.37	10	4288	2488	3353	9	12.90	6.60	8.03
Jefferson	Fulton	Liberty	45	" " " "	20	4.10	0.00	2.03	10	4558	2025	3237	10	9.90	5.30	7.06
	Samples	"	46	Spurck Paving Brick Co	9	4.30	0.50	1.80	7	3966	1828	2178	8	10.00	6.80	8.20
Jefferson	Main	Fulton	47	Purington Paving Brick Co	20	4.00	0.50	1.70	10	3385	16.3	2580	10	7.10	5.70	5.81
Main	Adams	Jefferson	48	" " " "	24	3.60	0.50	1.52	12	3590	812	2342	11	15.20	5.40	8.17
"	"	"	49	" " " "	16	0.70	0.00	0.39	5	3071	2280	2667	5	13.70	7.10	9.70
Main	Jefferson	Madison	50	" " " "	23	3.80	0.10	1.52	12	3049	1995	2578	11	8.80	5.00	7.09
Alley at	Up'r S'ge W'ks	Top Course	51	Spurck Paving Brick Co	20	9.70	5.30	7.05	10	2019	1084	1583	10	11.90	8.00	9.54
" "	" "	Bottom Course	52	" " " "	13	2.10	0.50	0.90	6	2944	937	1872	7	11.10	5.50	7.15
Jefferson	Harrison	Liberty	55	Purington Paving Brick Co	12	4.90	6.00	3.60	12	2834	1135	2279	11	10.30	3.80	7.67
Main	Madison	Monroe	56	" " " "	11	3.75	9.00	1.30	11	3716	1744	2681	11	9.00	4.50	6.00
"	Samples	"	63	St. Louis Press Brick Co	10	0.05	0.10	0.13	4	3680	2160	2917	5	11.70	8.80	9.92
Main	Bluff	Crescent	64	" " " "	12	0.80	0.00	0.27	6	3629	2193	2797	6	8.71	5.13	6.80
"	"	"	65	" " " "	12	2.20	0.10	0.83	6	3040	2123	2668	6	5.88	4.93	5.33
"	"	"	66	" " " "	5	3.27	0.40	2.31	5	2656	2159	2214	6	10 60	6.30	8.22
Alley Bl'k 7	Main	Hamilton	67	Spurck Paving Brick Co	12	6.30	1.70	3.84	6	2468	705	1883	4	7.80	5.10	6.60
" " "	"	"	68	" " " "	12	3.90	0.50	1.65	6	2988	987	2263	6	7 40	3.10	5.70
Alley Bl'k 13	"	Fulton	69	St. Louis Press Brick Co	12	2.30	0.00	0.43	12	3459	2003	3059				
" " "	"	"	70	" " " "	12	2.50	0.00	0.57					12	10.36	4 56	7.47
Main	Bluff	North	71	" " " "	10	1.10	0.40	0.78	10	3288	2044	2852				
"	"	"	72	" " " "	12	2 50	0.40	1.10					12	12.50	4 68	2.81
Alley Bl'k 4	Fulton	Liberty	73	" " " "	12	3.80	0.00	0.82	12	2637	1411	2137				
Fulton	Adams	Jefferson	76	Purington Paving Brick Co	12	5.68	0.59	1 90					12	8.57	5.14	7.23

TABLE II.

LARGE BRICK TESTS,

PAVING BLOCKS 4X8X12 INCHES.

On	From	To	Lot No.	Manufacturer.	Absorption, Per Cent—48 hrs.				Modulus of Rupture.				Abrasion, Per Cent—1 hr.				Remarks.
					No. tested.	Highest.	Lowest.	Average.	No. tested.	Highest.	Lowest.	Average.	No. tested.	Highest.	Lowest.	Average.	
Linn	Armstrong	City limits	1	Spurck Paving Brick Co	54	9.22	0.00	2.44	53	2327	262	1194	13	11.72	0.43	4.39	
	Samples		2	Peoria Paving Block Co	10	2 66	0.67	1.73					5	12.02	6.30	9.29	
	"		9	Grape Creek Clay Works	12	6.63	3.95	5.43	6	2006	560	1232	5	17.22	5.50	11 32	
Lincoln	Charlotte	Western	13	Peoria Paving Block Co	6	1.30	0.69	0.90	13	2487	874	1587	8	9.45	4 98	6 92	
"	Samples	"	21	Ottawa Paving Brick Co	4	2.30	2 11	2.20	3	1314	1198	1272	9	5 02	3 57	4 30	
Lincoln	Shelley	Warren	25	Spurck Paving Brick Co	8	4.79	1 47	2.67	8	2184	595	1559	2	6.40	5.85	6.02	North side
	Samples	"	26	Grape Creek Clay Works	6	5.80	2.20	3.51	3	2640	649	2081	3	4.43	2 04	3.57	
	"	"	28	Ottawa Fire Clay and Brick Co	2	2.81	2.26	2.55	1			1367				11.77	
Lincoln	Warren	Matthew	29	Spurck Paving Brick Co	8	3.26	0.66	2.03	5	1576	703	1218	4	9.40	4.23	5.03	North side
"	Matthew	Peter	30	" " " "	9	6.13	0.49	2.37	6	1741	815	1405	6	7.88	3 90	5.89	" "
"	Peter	Alfred	33	" " " "	15	8.60	0.10	2.64	8	1825	961	1377	2	5 59	4 88	5 21	" "
"	Alfred	Western	34	" " " "	6	2.90	0.70	1 50	6	3125	669	1584	3	5 78	4 99	5.26	" "
"	Charlotte	Western	36	" " " "	9	9.60	0.10	3.73	6	1924	546	1195	3	6.60	5.20	5.91	South side
"	Warren	Matthew	37	" " " "	9	2.80	0.30	1.70	6	2202	905	1275	3	7.70	4 50	5 8	" "
"	Samples	"	42	Ottawa Paving Brick Co	7	5.30	2.50	3.63	7	1512	335	986	7	10 86	5 22	6 70	
Lincoln	Warren	Matthew	53	Spurck Paving Brick Co	10	6.00	1.20	4 60	6	1858	589	1462	4	6.90	5.00	5.90	South side
"	Matthew	Peter	54	" " " "	7	5.66	0.50	3.31	7	1918	659	1258	3	7.30	2 9	5 16	" "

TABLE III.

BRICK TESTS.

SHOWING RESULTS OF TESTS ON OLD BRICKS TAKEN FROM PAVEMENTS LAID PREVIOUS TO 1894.

LARGE BLOCKS. GENERAL SIZE, 4X8X12 INCHES.

Bricks From Pavements			Lot.	Manufacturer.	Absorption, Per Cent—48 hrs.				Modulus of Rupture.				Abrasion, Per Cent—1 hr.			
On	From	To	No.		No. tested.	Highest	Lowest	Aver'ge	No. tested.	Highest	Lowest	Aver ge	No. tested.	Highest	Lowest.	Aver'ge
Lincoln	Charlotte	Sumner	83		9	13 34	1 41	9 58	5	1884	584	1799	4	14.72	6 32	9.55
Hamilton	Adams	Jefferson	84	Galesburg	18	11 56	0.14	3 53	9	1541	397	879	9	11 58	3 78	7 99
"	Jefferson	Madison	85		7	12 20	3 36	6 99	3	2307	871	1154	4	17 29	9.54	12 12
Eaton	Adams	Water	86	Peoria Paving Block Co	9	12 09	0 30	6 41	6	983	387	727	3	16.97	7.51	11.37
Washington	Fayette	Jackson	87	" " " "	4	10 81	2 93	5.78	3	1379	206	644	3	10 00	5.69	6.88
"	"	Hamilton	88	Spurck Paving Brick Co	6	9 02	0.83	3 74	3	917	497	728	3	9.28	5.80	6.73
Hamilton	Water	Washington	89	" " " "	6	5 09	0.52	2 63	3	1414	871	1100	3	6 50	4.64	5 46
"	Washington	Adams	90	" " " "	6	5 83	0 76	2.95	3	1782	709	1153	3	7.93	5 88	6.74
Fayette	Adams	Jefferson	91	Cuba Clay Works	6	4.49	2.03	2 75	3	1343	632	906	3	22 07	5.14	13 42
"	Jefferson	Madison	92	" " " "	6	5 35	2 22	3.66	3	770	633	720	2	6.61	5.48	6.04
"	Water	Washington	93	" " " "	5	5 59	1 30	4 05	3	1009	827	929	3	10.02	6.88	8.45
"	Washington	Adams	94	Ottawa Fire Clay and Brick Co	5	6 19	3.42	4 72	3	1029	586	851	3	8.87	6 78	8.07
"	Madison	Monroe	95	" " " "	5	3.74	1 58	2 45	3	723	464	685	3	15 16	8 20	11.35
"	Monroe	Perry	96	" " " "	6	5 17	1 78	2 97	3	961	474	727	2	16.67	5 53	12 81
"	Perry	Glendale	97	" " " "	7	3.49	1 17	2 15	3	728	386	505	2	21 82	11 60	16 70
"	Glendale	Knoxville	98	" " " "	8	3 05	0.81	2 14	6	869	445	600	3	17 58	12.57	14.65
Adams	Hamilton	Main	99	Spurck Paving Brick Co	5	6.51	1.33	3.17	3	2446	1295	1792	3	7.89	5 80	6 58
"	Main	Fulton	100	" " " "	5	5 55	1 13	3 66	3	1375	581	957	3	5.02	4 81	4 90
"	Fulton	Liberty	101	" " " "	6	13 79	2.57	5.86	3	2160	1351	1706	3	9 81	7 49	8.35
"	Liberty	Harrison	102	" " " "	5	6 78	2.31	4 60	3	2004	1094	1679	3	11.29	8 02	9.51
"	Harrison	Bridge	103	" " " "	6	9 33	2.89	5 29	3	1549	786	1081	3	10 40	5.76	8.67
"	Bridge	Walnut	104	" " " "	6	10 51	1.46	6 17	3	1065	564	761	2	4 75	4.06	4.40
"	Walnut	Chestnut	105	" " " "	6	13 63	1 72	5 84	3	1663	792	1173	3	10 70	5 11	7 93
"	Chestnut	Oak	106	" " " "	6	15 21	2 38	8 03	3	1132	607	800	3	17 48	3 49	11.01
"	Oak	Elm	107	" " " "	6	16 22	3 51	7.17	3	1273	562	877	3	11.47	5 02	8 15
"	Elm	Maple	108	" " " "	6	8 12	2 93	4 62	3	984	407	667	3	7.14	4 40	5.81
"	Maple	Persimmon	109	" " " "	6	8 72	1 40	4 06	3	616	147	1416	3	9 81	3 49	6.35
"	Persimmon	Locust	110	" " " "	6	6.79	2 48	4 99	3	1593	597	1197	3	10 92	6 28	8.43
"	Locust	Pecan	111	" " " "	4	13 37	4 83	7 10	3	1669	1463	1536				
"	Pecan	Cedar	112	" " " "	6	7.43	2 45	4 30	3	1461	1133	1249	3	9 21	6 53	7.96
Franklin	Adams	Alley	113	" " " "	5	8 20	0 69	3.71	3	1656	640	1095	3	8.66	5.14	6.39
"	Alley	Third	114	Ottawa Fire Clay and Brick Co	4	6 79	1 38	3 93	3	968	631	839	3	5 69	3 62	4 37
"	Third	Fourth	115	" " " "	4	3 06	2 45	2 78	3	1175	801	972	3	9 49	5 95	7.76
"	Fourth	Fifth	116	" " " "	5	5 09	2 49	3 74	3	1322	633	818	3	10 15	7 99	9.08
"	Fifth	Sixth	117	" " " "	5	7 22	2 75	4 11	3	893	307	597	3	13.78	10 15	11 74
"	Sixth	Seventh	118	" " " "	5	3 64	0.35	2 78	3	1174	491	804	3	13 30	8 17	10.40
Perry	Franklin	Main	119	" " " "	6	5.17	1.46	2 53	3	1671	410	1026	3	8 02	5.90	7.25
Hamilton	Madison	Monroe	120	" " " "	8	10.91	1 30	4 55	3	1480	1209	1355	4	27 10	18.98	24 48

TABLE IV.

CEMENT TESTS

UTICA CEMENT.

Lot	Used. On	From	To	Fineness Per Cent Passed. No. 20 Sieve Av.	No. 50 Sieve Av.	No. 74 Sieve Av.	Strength Per Square Inch. Neat. No. test ed.	24 Hours. H	L	Av.	No. test ed.	7 Days. H	L	Av.	No. test ed.	60 Days. H	L	Av.	No. test ed.	90 Days. H	L	Av.	No. test ed.	1 to 1 7 Days. H	L	Av.	No. test ed.	1½ to 1 7 Days. H	L	Av.	No. test ed.	2 to 1 7 Days. H	L	Av.	Set Tests. Initial Set. min.	Final Set. hr min
45	Jefferson	Liberty	Fulton	99.7	91.7	81.1	7	482	57	70													1				465	9	137	88	105	9	127	75	98	15	2—23
47	Walnut	Street	Sewer	99.8	91.6	78.5	8	118	45	77																											10	1—45
48	Bridge	Washington	Adams				6	138	82	109													1				382	3	245	228	234	3	182	155	167		
49	Walnut	Street	Sewer				3	120	97	108																									4	95	90	93		
53	Adams	Hancock	Green								9	260	167	223																								
54	Main	Knoxville	Glendale				16	104	65	78	4	124	192	209	1																							
56	Adams	Green	Wayne				8	89	48	68	4	226	190	212	2	379	254	314																			
57	"	Hamilton	Fayette				8	97	63	72	2	188	183	185	1								1				373											
58	Walnut	Street	Sewer	99.8	88.0	76.9	8	78	48	61																												
59	Main	Bluff	Crescent	99.8	89.1	78.6	8	93	59	74	4	252	152	209	1								1				391											
60	Illinois	Washington	Peoria				4	108	75	92	2	210	188	199	1								1				360											
61	"	Peoria	Missouri	99.9	89.4	79.8	8	110	59	73													1				350											
62	"	Missouri	California				10	89	52	67													2				358											
64	Adams	Jackson	Eaton				8	80	61	68	4	189	102	130										378	338	358												
65	Al. Blk. 7	Main	Hamilton				9	75	53	65																												
66	Main	Monroe	Perry				6	97	63	79																												
67	Illinois	California	New York				9	85	30	64																												
68	Adams	Morton	Vorie				8	85	62	71																												
69	"	"	"				8	77	57	67																												
70	Main	Bluff	Crescent				8	103	64	84																												
74	Fulton	Washington	Adams				6	85	55	68																												
75	"	"	"				8	74	40	59					3	284	200	236																				
76	Adams	Voris	Spring								8	245	161	195													8	300	158	170†	8	120	67	87†				

*30 days. H. Indicates Highest.
†90 days. L. " Lowest.
Av. " Average

TABLE V.

CEMENT TESTS

UTICA CEMENT.

Lot	Used. On	From	To	Fineness Per Cent Passed. o 20 Sieve Av.	No. 50 Sieve Av.	No. 74 Sieve Av.	Strength Per Square Inch. Neat. No. test ed.	24 Hours. H	L	Av.	No. test ed.	7 Days. H	L	Av.	No. test ed.	60 Days H	L	Av	No. test ed.	90 days. H	L	Av.	1 to 1 Pe. ct ed.	7 Days. H	L	Av.	1½ to 1. No. test ed.	7 Days. H	L	Av.	2 to 1. No. test ed.	7 Days. H	L	Av.	Set Tests. Initial Set. min.	Final Set. hr. min
2	Walnut	Street	Sewer	99.9	92.9	81.3	5	67	49	61	5	164	122	142	6	253	216	*235	1				390														
3	Spring	Street	Sewer	99.6	89.9	78.9	17	73	41	54	13	165	85	122																						
5	Walnut	Street	Sewer	99.7	91.5	80.7	10	103	47	65					3	353	292	324													22	145	70	97			
6	"	"	"	100.0	93.6	83.1	5	105	61	85																					9	112	80	96	15	1 55
7	Al. Blk 12	Fulton	Liberty	100.0	92.8	82.4	7	125	65	96																	7	160	102	142	3	107	94	99	15	1 30
8	Al. Blk 6	Main	Fulton	99.8	88.9	77.9	5	142	50	79																	5	166	114	137	5	137	90	113			
9	Main	Wash'ton	Adams	99.9	90.6	80.9	6	90	57	67	1			225													7	168	113	137	7	120	77	101			
10	Walnut	Street	Sewer	99.9	92.4	82.3	2	70	65	67																												
11	Spring	Street	Sewer	99.8	90.4	80.3	3	65	60	62																												
13	Main	Adams	Jefferson	99.9	92.5	77.5	6	90	67	77																	7	168	92	135	6	120	85	100			
14	Walnut	Street	Sewer	99.9	88.0	75.8	6	125	75	98																									3	58	30	53	21	4
15	Al. Blk 18	Fayette	Eaton	99.9	89.9	79.3	5	68	43	55																	5	107	40	73	5	70	36	54				19	2 20
16	Jefferson	Liberty	Fulton	99.9	89.2	78.2	9	70	30	45																	7	157	93	121	6	96	62	73				178	2 10
17	Walnut	Street	Sewer				2	60	52	56																									2	53	51	52		
18	Main	Adams	Jefferson				3	60	45	54																												
19	Main	"	"				3	57	50	59																												
20	Jefferson	Fulton	Main				3	70	58	64																												
21	"	"	"	99.8	89.7	80.6	20	70	50	60				1				†210																			
22	Main	Jefferson	Madison				4	55	35	44																												
23	"	Madison	Monroe	99.8	91.0	79.2	5	58	42	50																	4	157	101	126	4	103	70	90	4	78	51	62	14	1 40
24	"	"	"	99.6	93.2	82.5	5	53	10	53	1			178	1			†260									5	130	101	119	5	103	78	89				15	
25	"	Wash'ton	Adams	99.9	90.2	81.2	5	72	57	62	1			138													6	175	85	123	6	100	50	73				14	
26	"	"	"	99.9	90.3	80.2	8	60	43	51																												
27	Bridge	F. Bridge	Water				9	90	57	54																												
28	Spring	Street	Sewer				2	60	44	52																	2	160	155	157					2	80	75	77		
29	Adams	Wash'ton	Fayette				8	92	53	74																	4	233	137	178	6	160	83	105					
30	Jefferson	Harrison	Liberty	99.9	86.6	74.9	8	92	47	60																	6	178	125	150	6	115	77	94					
31	Main	Adams	Jefferson	99.9	91.6	78.8	8	80	45	56																	6	363	158	199	6	132	90	107				19	1 40
32	Walnut	Street	Sewer				8	78	49	61	3	220	130	167																					12	93	58	74	22	
33	Jefferson	Liberty	Fulton	99.8	88.1	77.1	8	75	53	60																	6	207	160	174	5	253	122	†186					
34	Main	Monroe	Perry				8	67	46	56																												
35	Bridge	Water	Wash'ton				8	76	48	63																												
37	Illinois	Encav'le	Wash'ton				9	98	40	70																												
38	Jefferson	Fulton	Main				9	108	47	57																												
39	Main	Jefferson	Madison				7	83	33	48																					7	160	98	†134					
40	Bridge	Wash'ton	Adams	99.7	91.8	78.1	6	81	45	64																												
41	Main	Madison	Monroe				8	143	48	70																												
42	Walnut	Street	Sewer	99.8	91.8	82.1	4	58	40	48																												
44							6	75	38	51																												

*30 days. H. means highest.
†15 days. L. " lowest.
Av. " average.

TABLE VI.

CEMENT TESTS.

LOUISVILLE CEMENT.

Lot	Used. On	From	To	Fineness Per Cent Passed. No. 20 Sieve. Av.	No. 50 Sieve. Av.	No. 74 Sieve. Av.	Strength Per Square Inch. Neat. 24 hours. N. T.	H.	L.	Av	72 hours. N. T.	H	L.	Av	7 days. N. T.	H.	L.	Av	60 days. N. T.	H.	L.	Av	90 days. N. T.	H.	L.	Av	1 to 1. 7 days. N. T.	H.	L.	Av.	1½ to 1. 7 days. N. T.	H.	L.	Av.	Set Tests. Initial Set. min.	Final Set. hr min	Remarks
4	Walnut	Street	Sewer	97.7	83.9	77.4	10	128	98	110																									10-	0—17	
22	"	Semple	"	99.9	89.1	80.5	3	117	108	111					3	185	152	159	1																	7-	0—18	†30 days
36	Perry	Main	Hamilt'n	99.9	89.5	80.3	9	142	57	122																	4	70	30	50								
46	"	Hamilt'n	Fayette	99.7	84.5	76.5	8	143	100	121																	6	139	83	105	7	60	22	41				
50	"	Fayette	Jackson				8	138	89	115	4	148	100	129	6	177	122	147													6	73	31	58	7-	0—24	1 to 1. 90 days. No tested. 2
52	"	Jackson	Eaton				8	173	105	136					8	195	142	155					4	440	350	395	6	118	62	87								
55	"	Eaton	Green	99.9	88.4	81.2	8	167	80	140					5	202	145	164	4	385	303	332	2	412	370	391									10½	0—27	H. 240
63	"	Green	Morgan				8	171	142	161					4	198	170	181	1			300	2	372	345	358											L. 200;
72	"	Evans	Voris				8	188	150	169					3	364	345	352																			Av. 220.

H. indicates Highest.
L. " Lowest.
Av. " Average.
N. T. " No. Tested.

TABLE VII.

CEMENT TESTS.

PORTLAND CEMENT.

Lot	Used	Fineness Per Cent Passed. No. 20 Sieve. Av.	No. 50 Sieve. Av.	No. 74 Sieve. Av.	Strength Per Square Inch. Neat. 24 hours. N. T.	H.	L.	A v	72 hours. N. T.	H	L.	A v	7 days. N. T.	H	L.	A v	4 to 1. 7 days. N. T.	H.	L.	A v	Set Tests. Initial Set. min.	Final Set. hr min	Remarks.
43	Cement Walks to Parks	100.	99.9	98.0	8	270	160	217					8	450	360	404	3	70	50	60	53-	5-0	
51	" " "	100.	99.9	98.3	6	202	132	165	4	333	303	319	6	520	413	450	7	80	59	74	60-	5-0	Fineness, 100 Sieve, 98.7

H. indicates Highest.
L. " Lowest.
Av. " Average.
N. T " No Tested.

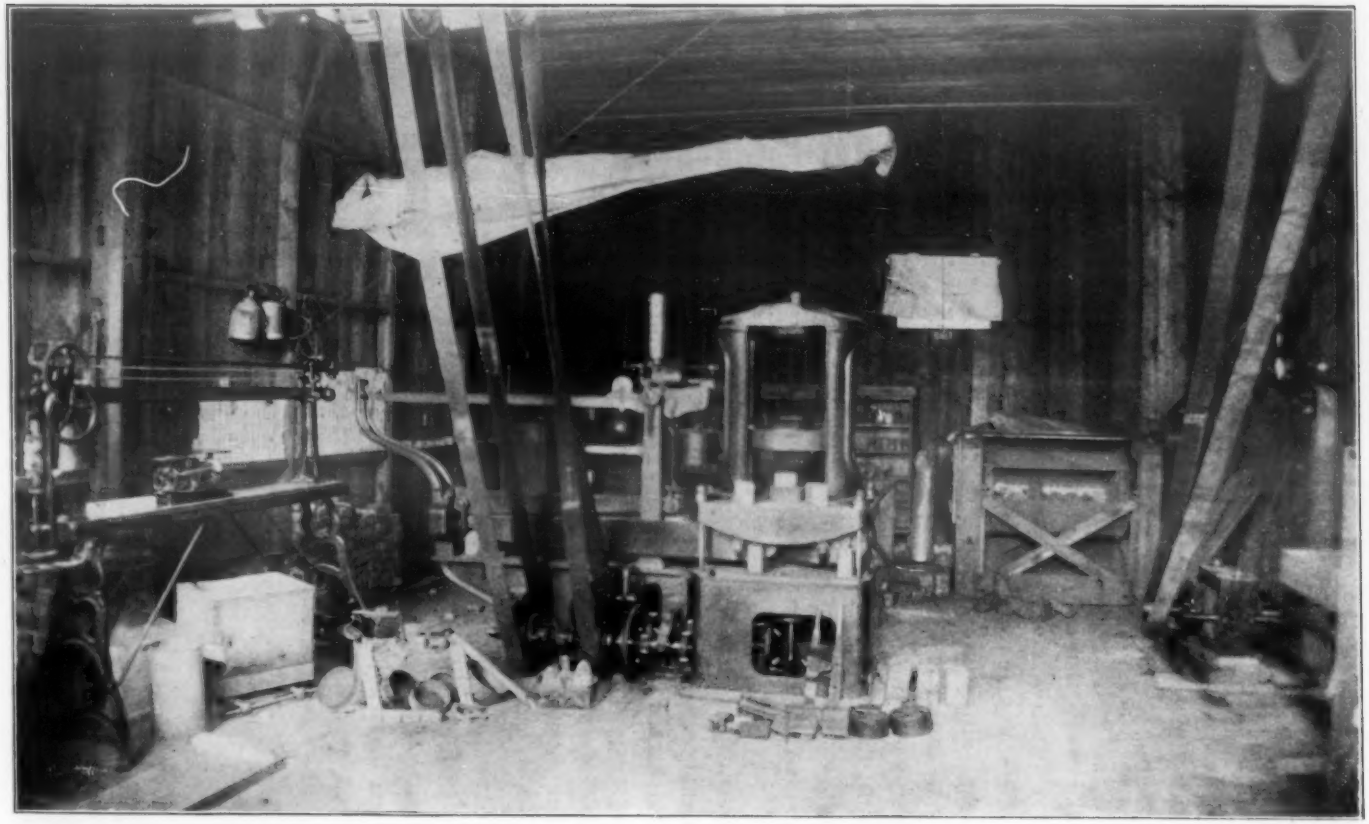
samples from each block, where the bricks were of a known make which had previously been tested and used, thus testing about one brick in each 4,000 laid.

The bricks obtained for testing are taken to the testing room and marked in lots and are then weighed, the specific gravity taken, and dried thoroughly in a gas oven, after which they are again weighed and one-half of the lot are used to determine the modulus of rupture, and one-half for the abrasion test.

The bricks used for the first test are placed in the testing machine and broken as a beam, with the pressure applied at the center, the brick lying flatwise, and the modulus of rupture figured by the formula $R=\frac{3l}{2bd2}W$, where R=modulus of rupture, l=length between supports, b=breadth in inches, and d=depth in inches and W is the breaking load in pounds. In 1894 bricks for paving work were required to give a strength of 1,800 pounds per square inch when thus tested. In 1895 this was increased to 2,000 pounds, and the specifications for 1896 require a modulus of rupture of 2,200 pounds per square inch. There has been a notable increase in the transverse strength of bricks submitted each year, many of the samples tested during the past season developing a modulus of 4,000 pounds, with a maximum of more than 6,000 pounds per square inch.

The sides of the bricks are not made smooth and straight, but are tested as taken from the ground. The bricks are so hard that we have been unable to devise a cheap and expeditious means for grinding the faces true. If the faces were ground to parallel planes, so that the bricks rested squarely upon the supports, and the pressure was applied evenly over the whole width, a much higher strength would be obtained.

The samples for the abrasion test are placed in a cast-iron rattler two feet in diameter and three feet long, together with three hundred pounds of ordinary scrap-iron, the pieces ranging from one-fourth of a pound to five pounds in weight. Not more than six bricks are tested at one time. The rattler is then revolved at the rate of fifteen revolutions per minute for one hour, and the loss in weight noted. No brick of the ordinary size, 2½ x 4 x 8 inches, shall lose more than nine per cent. of its own weight when tested



VIEW OF THE PEORIA MUNICIPAL TESTING LABORATORY.

one hour in the above manner, and the maximum allowable loss for a block 3 x 4 x 9 inches shall be seven per ce t. of its own weight. In order to make the conditions uniform, the cast-iron was first revolved in the rattler until worn smooth, and as scrap-iron is added the additional pieces are worn smooth before the bricks are tested. Experiments were made with the rattler at different speeds, and fifteen revolutions per minute adopted, because at this speed the bricks were tumbled, and not carried around with the rattler. Three hundred pounds of scrap-iron was used, because this weight filled the rattler for a depth of about four and one-half inches, and insured abrasion on each brick at every revolution. The rattler may be larger than is needed ordinarily, but was made this size in order to test the 4 x 5 x 12 inch blocks. When the experiments were begun, much larger pieces of scrap-iron were used, some of them weighing nine or ten pounds, with few small pieces in the lot, and considerable trouble was experienced by these large pieces of iron breaking the bricks, one or two from each lot usually being broken, but since limiting the weight of any one piece to five pounds, which is nearly the weight of the small brick, and using pieces of all sizes uniformly ranged to one-fourth of a pound, no trouble from breakage has been experienced. During the first part of the present season we found that the scrap-iron and bricks were sliding around in the rattler instead of being tumbled, and an examination showed the surface of the rattler had worn as smoothly as glass. This difficulty was remedied by bolting wrought-iron strips along the sides.

If ninety per cent. of the bricks delivered upon the street are equal to those which stand the tests, the lot is accepted, and they are sorted when laid. If not more than eighty per cent. stand the requirements, the bricks must be sorted in the piles before they are laid, and are again sorted when laid. If sixty per cent. or less fail to meet the requirements of the specifications, the entire lot is rejected.

METHOD OF TESTING CEMENT.

The cement samples taken from the cars or store-house by the city tester are tested for fineness, color, checking and tensile strength. The requirements for cement and methods of testing can probably be best explained by quoting the specifications:

All cement for concrete foundation shall be what is commonly known as American natural hydraulic cement, of quality equal to the best obtainable in the markets. All Portland cement used on the work shall be the best obtainable in the markets. They will be subjected to rigid inspection, and that rejected shall be immediately removed by the contractor.

The contractor must submit the cement for inspection and testing at least ten (10) days before using, and such inspection and tests will be made only from samples obtained by the inspector from cement delivered on the work. The inspector shall be notified of each delivery of cement. All cement must stand the following tests:

Two cakes, three inches in diameter and one-half inch thick, with thin edges, will be made. One of these cakes as soon as set will be placed in water and examined from day to day. If the cake exhibits checks, cracks or contortions, the cement will be rejected. The other cake described will be used for setting and color tests.

The time will be noted when the cake has become hard enough to sustain a wire one-twelfth inch in diameter loaded with one-fourth pound. When the wire is sustained, the cement has begun to set, and this time shall not be less than ten (10) minutes for natural cement, nor less than forty-five (45) minutes for Portland cement.

When the cake will sustain a wire one-twenty-fourth inch in diameter loaded with one pound, the set is complete, and this time must not be less than one (1) hour nor more than three (3) hours for natural cement, nor less than two (2) hours nor more than six (6) hours for Portland cement.

The cake used for setting test will be preserved, and when examined from day to day must be of uniform color, exhibiting no blotches or discolorations.

The cement must be evenly ground, and, when tested with the following standard sieves, must pass at least the following percentages:

	Natural.	Portland.
No. 20 sieve, having 20 meshes per lineal inch.....	100%	....
No. 50 sieve, having 50 meshes per lineal inch.....	90%	98%
No. 74 sieve, having 74 meshes per lineal inch.....	80%	94%
No. 100 sieve, having 100 meshes per lineal inch.....	....	90%

The diameter of wire for sieves being respectively:

For No. 20 sieve, No. 28 Stub's wire gauge.
For No. 50 sieve, No. 35 Stub's wire gauge.
For No. 74 sieve, No. 37 Stub's wire gauge.
For No. 100 sieve, No. 40 Stub's wire gauge.

All cement for test briquettes will be mixed with barely sufficient water to make a stiff mortar. The neat briquettes to be pressed into the moulds by hand and the sand briquettes to be compacted by light tapping.

The sand for cement tests will be crushed quartzite of such fineness that all will pass a sieve of 20 meshes per lineal inch, and none of it a sieve of 30 meshes per lineal inch.

The required tensile strength per square inch shall be as follows:

	Natural.	Portland.
Neat Cement—		
One day—till set in air, remainder of time in water	60 lbs.	150 lbs.
One week—one day in air, six days in water	150 lbs.	400 lbs.
Cement one part and sand two parts—		
One week—one day in air, six days in water		75 lbs.
Cement one part and sand one and one-half parts—		
One week—one day in air, six days in water		85 lbs.
Cement one part and sand three parts—		
One week—one day in air, six days in water		140 lbs.

Briquettes for the seven (7) day tests shall be covered for the first twenty-four (24) hours with a damp cloth.

The benefits derived from the use of this laboratory are difficult to enumerate. It has placed public work upon a firm basis, where sound business principles are applied in the selection of material. The materials to be used must possess certain qualities, which are determined in a well-defined manner, thus allowing the manufacturer by decreasing his risk to furnish such material upon a small margin of profit. It has procured the best materials on the markets for public improvements. It has shown the manufacturer the faults of his material, and has forced him to produce a superior article by direct comparison with materials of other manufacturers tested in exactly the same manner. It has reduced the cost of the improvements, and insured one dollar's worth of material for every dollar expended. It has given the citizens confidence in public works. The position of the city in determining the quality of the materials is an assurance to the contractor that the entire work will be conducted upon a sound business basis, which admits a better class of contractors to competition, who are willing under these conditions to work for a small certain profit, rather than chancing large profits to the uncertainties of a political superintendence.

The effect of testing materials upon the prices of work can be shown by a comparison of the cost of brick pavements. Previous to 1894 large paving blocks upon a six-inch sand or gravel foundation cost from $1.45 to $2.04 per square yard, exclusive of excavation. In 1894 small bricks on a six-inch broken-stone concrete foundation, costing the contractor more than the other construction, was laid for from $1.39 to $1.60 per square yard, exclusive of excavation, while in 1895 the prices for the same work ranged from $1.24¾ to $1.36 per square yard.

ALMON D. THOMPSON was born in Gilman, Ill., in 1868, and graduated from the high school at that place in 1887. In the fall of 1888 he began his engineering career as rodman and chainman upon drainage work in the vicinity of his home. In the fall of 1889 he entered the college of engineering at the University of Illinois, and graduated from the department of civil engineering in June, 1893. From June to October, 1890, he was in the employ of the Illinois Central Railroad as leveller on ballast work. From May to October, 1892, he was employed in general city surveying and in charge of the belt line survey at Peoria, Ill., and in the same work from April to July, 1893. He entered the employ of the city of Peoria in July, 1893, as sewer inspector, was made assistant engineer in charge of sewers the same fall, and the following spring was placed in charge of paving work for the city, which position he held until the 1st of May, 1895, when he was appointed city engineer.

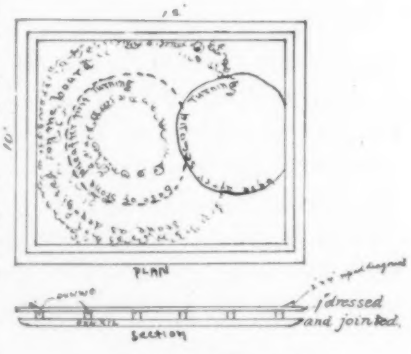
BRICK PAVING FROM START TO FINISH.

By M. Nicholson, C. E.

II. THE FOUNDATION.

THE preparation of the road-bed beneath street car tracks is of so much importance to both the city and the street car companies that a perfect understanding should be reached before any work is done as to just what each is to do, and who is to pay for it. In making this agreement it should be stipulated that the tracks must be removed from the roadway so that the sub-grade will be accessible for grading and rolling, as it is very difficult—indeed, almost impossible—to properly prepare the sub-grade under a track and keep it in position. After the track is replaced and concreted in position, cars should by all means be kept off of it until the concrete is thoroughly set.

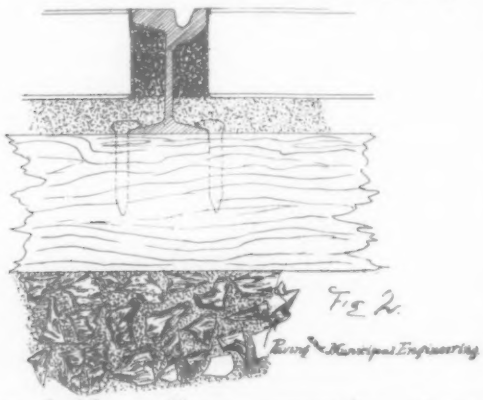
The form of concrete mixing-board shown in the accompanying illustration is one which I have found very convenient. It is easily made, and readily moved along the work as it progresses by hooking shovels behind the 4 x 4 inch cross pieces and dragging it on the longitudinal 4 x 4 inch runners, which are rounded at the ends for this purpose. The strip around the edge is very useful in preventing waste of materials off of the board, and does not interfere with the manipulation of the concrete. The size of the board will,



Concrete Mixing Board.

of course, depend somewhat on the width of streets to be paved, and whether one or two boards are to be worked together, but they should be made large enough for the manipulation of a batch of concrete containing at least one barrel of cement; a board ten feet square will do this.

By using cement in sacks, as it is usually put up, it will be found that one sack of cement, as packed in the sack, is equal to about one-half an ordinary iron wheelbarrow full—that is, two sacks of cement well packed into a barrow will make a slightly rounded up barrow full, which gives a convenient and rapid method of measurement for the materials. A little practice will enable an inspector to secure and maintain a remarkably uniform proportion of materials.



In mixing the sand and cement my practice is to spread the sand over the board approximately even, then empty the required amount of cement on the sand and spread it out evenly, then by turning with shovels mix until no streaks of sand or cement show, but the mixture shows a uniform color throughout. Draw this out on the board near the edges, leaving the center lower than the edges, then add water (usually by pouring from a bucket) to the center of the mixture and by rapidly shoving the hoes to and from the center, gradually pushing in all of the dry mixture, and working the same to a moderately stiff mortar of uniform consistency. Spread this over the board and add the proper amount of broken stone, by rolling it onto the board in barrows and dumping it carefully around the outer edges leaving a small amount of mortar uncovered in the center; when deposited in this manner it prevents the mortar from being forced out over the edges of the board and wasted, besides forcing more mortar to the center of the board into the open space. Into this the stone and mortar should now be turned with the shovels, beginning at the outer edges and working

toward the center, until the whole mass is piled into a cone shape. Two expert shovelers should now be placed side by side, on the side of the pile nearest the place where the concrete is to be deposited, and by shoveling together from the bottom edge of the pile, turning the concrete over with a backward motion of the shovels as it leaves them, reforming the pile near the edge of the board, thus turning the whole mixture a second time.

As soon as this reforming of the pile has fairly begun it should be carried off on shovels by the other workmen and deposited in place, each shovelful being turned over as it is deposited on the edge of that already in place. One or two men should level off the concrete nearly level with the tops of the grade stakes as fast as it is deposited, and others should follow immediately after them, tamping it to a uniform surface. This tamping should be done in such manner as to thoroughly compact the concrete, as its strength can be seriously injured by omitting or slighting the tamping.

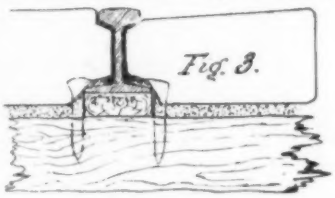


Fig. 3.

The quality of the sand is frequently a matter of small choice, but where possible should be not only clean and sharp but irregular in size, such as will pass through sieves of from twenty to thirty meshes per inch. It should be kept on boards to prevent shoveling up dirt with it.

Tests should be made of each carload of cement before any is used and a complete record kept of each test from beginning to end of the work. When the cement is in sacks samples taken from every fifth sack will generally give a fair average of the carload.

Machine broken stone should not be larger than two inches. I have selected this size and manner of breaking after trying both hand and machine crushed stone and sizes larger than two inches. I have secured decidedly better results from the two-inch machine broken stone than from any other. In breaking the stone the crusher should be set for two-inch size and the stone passed over a screen with openings not larger than one-half inch, so that only the dust and finest stone may be removed, as the concrete will be all the better for having the stone range in size from one-half to two

inches. If only hand-broken stone can be obtained the addition of gravel will improve the concrete.

The object of applying the covering of sand on the concrete as soon as completed, as specified, is to prevent the concrete from being dried out by the heat of the sun before it has become thoroughly set and allow it to harden at an even temperature. The time allowed for setting before brick is laid upon it will vary with the cement used. Quick-setting cements are preferable on account of the saving in time necessary for sufficient hardening to allow the brick to be laid.

The thickness of the cushion layer of sand is a question upon which there is considerable difference of opinion, as it varies in different places from one to three inches. The tendency is, however, towards the smaller amount in recent practice, and my opinion is that one and one-half inches is ample, and that less than one inch should not be used.

As the accuracy of the finished pavement will depend mainly upon the accuracy with which the sand cushion is formed, it is important that especial care should be taken in this matter. Where it is practicable to do so, it is best to use templets with which to strike the surface of the sand, but it frequently happens that this can not be done at a reasonable cost, in which case a sand-bed rake must be used. As the proper use of this tool requires considerable skill, it should only be used by men trained to the work. A convenient method of setting the grade of the surface of the sand bed is to stretch a chalk-line from the top of the curb on one side of the street to the top of the curb opposite; it will then represent the line drawn on the cross section from one curb top to the other, and by measuring down from this, at the ordinates, the distances as shown on the cross-section, an accurate section may be struck on the sand at any desired station, and by striking the gutter line on the curb and $\times$ longitudinal grade lines from one station to the next, at convenient distances apart, the sand bed can be surfaced so that the brick, when laid and rammed, or rolled, will conform exactly to the desired cross-section. In setting all grades on the sand bed, proper allowance should always be made for settling of the brick when rolled or rammed. This will generally be from one-quarter to three eighths of an inch. It is best, especially where

grades are light, to set the gutter grades with an engineer's level rather than depend upon measuring down from the top of the curb. By settling this gutter grade at the finished surface of the brick and snapping it on the face of the curb with a chalk-line, it will serve to obtain the sand bed grade by holding a brick on edge, end against the curb, top about one-fourth of an inch above the chalk-line, then dragging it along the curb through the sand, thus striking off the sand at the proper grade for receiving brick.

M. NICHOLSON.

[TO BE CONTINUED.]

THE PARK SYSTEM OF BOSTON.

By Sylvester Baxter, Secretary of the Metropolitan Park Commission.

III.

THE great wilderness reservation of the Middlesex Fells has exceptional importance in the history of the Boston park movement as the subject of an agitation for a public domain, maintained for many years by the three venerable lovers of nature, now dead—Elizur Wright of Medford, Wilson Flagg and John Owen of Cambridge—together with many other earnest and public-spirited people. The public sentiment aroused by this agitation finally led to the establishment of the Metropolitan park system. The final act in the conversion of this magnificent region into a public reservation took place on February 2, 1894, when 1,583 acres were taken by the Metropolitan Park Commission. In connection with various previous acquisitions for water-supply purposes by the cities of Malden and Medford and the towns of Melrose and Winchester, and for park purposes by the town of Stoneham, together with a tract given into charge of the trustees of public reservations, this act unified the entire territory in a great public domain of nearly 3,200 acres of land and water.

The Middlesex Fells lies in the five municipalities of Malden,

Medford, Melrose, Stoneham and Winchester. In the earliest colonial days it was known as "The Rocks" and subsequently as the "Five-Mile Woods." A large portion of the territory was at first common land, held by the adjacent towns. In 1879 the author of this article first applied the name of Middlesex Fells in a Boston newspaper in describing the region as particularly suitable for a great public forest domain. The name, in its application to New England landscape of the old Saxon term for wild rock-hills, common in England and corresponding to the German "felsen," struck the popular fancy, and, adopted by the Appalachian Club at the recommendation of the Malden Scientific Field Club, has ever since been retained.

The character of this reservation is that of a plateau whose surface is minutely broken into numerous comparatively small hills, bowls and vales. In the words of the landscape architects, "The landscape pleases chiefly by reason of the intimate mingling of many types of scenery and objects of interest. Here is a cliff and a cascade, here a pool, pond or stream, here a surprising glimpse of a fragment of blue ocean, or again a faint blue vision of a far distant mountain." Mr. Manning, in his report on the vegetation of the reservation, says that it was the stately timber and the wilderness in which it stood that impressed the early observers of the Fells region.

The first act of the Metropolitan Park Commission in the fulfillment of its trust was the taking of the tract of land along Beaver brook in Belmont and Waltham containing the magnificent oaks, and the cascade that was sung by Lowell. Though small in size, it is of great importance by reason of its remarkable landscape beauty and its associations with one of the greatest and noblest of American poets. Its area is 58½ acres, but its rural character is on nearly all sides insured against the intrusion of discordant elements.

The site occupied by the oaks, the finest group of their kind in the United States, forms one of the most beautiful pastoral and park-like landscapes in the neighborhood of Boston. The oaks grow along the line of a kame, as the geologists call the drift formation believed to have been created by the action of sub-glacial streams. This kame is a remarkably fine example of its kind. Its

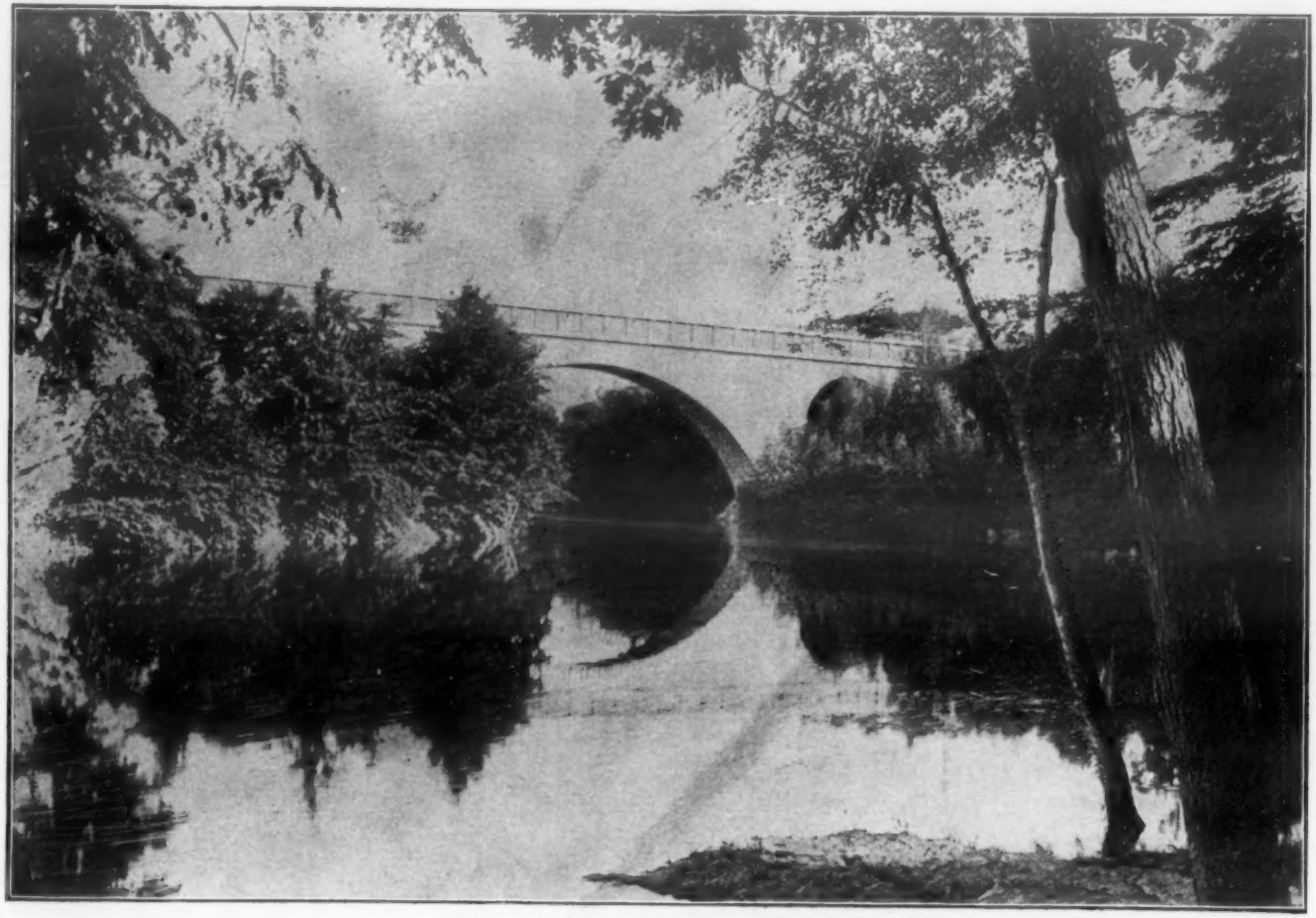
A FEATURE OF BOSTON'S PARK SYSTEM—MIDDLESEX FELLS—THE CASCADES.

serpentine form, with Beaver brook flowing swiftly at its base, gives beautiful diversity and finely modeled contours to the landscape.

The grand old trees were originally called the Beaver Brook Oaks, but when Waverley station was established near by that name became their popular designation. Their old name is now restored. Mr. L. L. Dame, in his "Typical Elms and Other Trees of Massachusetts," says that while solitary oaks as large as these are not uncommon, it is not likely there is another group of such noble trees within the Eastern States. "With one exception, they are white oaks, now twenty-five in number. The sturdy individualism characteristic of the oak pushes now and then to the verge of eccentricity. Each differs from its fellows; each is worthy the pencil of the artist; as a whole they admirably illustrate the variant types of the species." Agassiz once roughly estimated the age of a hollow tree, prostrated by the wind, at 1,000 years. Nearly fifty years ago one of the smaller trees was cut down and Lowell counted its rings. They numbered over 750. Mr. Dame says that the largest, and presumably oldest, of the group may well have sheltered Leif Ericsson beneath its branches, and must have been at its best when Columbus rediscovered America.

The inspiring example of the establishment of Lynn Woods as the second largest municipal pleasure-ground in the United States furnished the immediate incentive to the movement that resulted in the metropolitan park system of Boston. "Such is the gift which the good God, working through social history and natural history and statute laws and the hearts of men, has given to the present and future people of Lynn," wrote Edward Everett Hale. Ten miles from the State House, and within the metropolitan parks district, this magnificent public woodland is practically a part of the Boston system, corresponding on the north to the Blue Hills, which lie at the same distance in the opposite direction. It came about in this wise that the city of Lynn dedicated 2,000 acres, or one-third of its entire area, to public uses, reconstituting as a public domain a region that for nearly a century was held in common, for it was not until 1706 that it was divided up among the freeholders:

Three different causes led to this consummation. The wilderness region offered excellent advantages for an additional water supply that was urgently needed. By damming the outlets of sev-



HEMLOCK GORGE, NEWTON UPPER FALLS.

eral swampy valleys between the rocky hills and clearing away the growth, a series of beautiful ponds was created, with a capacity of many millions of gallons. In their general aspect these ponds are not to be distinguished from natural lakes. Then to assure the water against pollution by human occupancy of the drainage areas the greater portion of the surrounding lands was taken by the water-board, to be preserved in a state of nature. The second factor was a movement on the part of several nature-loving citizens who conceived the idea of securing as much of this territory as possible by gift or by purchase with voluntary contributions. A board of free public forest trustees was chartered by the legislature to hold in trust for the people of Lynn whatever of this wild land should be conveyed to them. The late Cyrus M. Tracy, a distinguished naturalist and antiquarian, headed the movement. By this plan various scattered holdings of about 150 acres, all told, were secured. But there was no available means for connecting and unifying these tracts, and the movement came to a standstill. So the general park act was resorted to, with its power of condemnation. The act was accepted by the city, and $20,000 having been raised by private subscription, an appropriation of $30,000 was made by the city in 1889. With this sum not only was enough land secured to make the entire area 1,600 acres, including 300 acres of water-surface, but several miles of pleasant road were constructed. The total area has recently been increased to something over 2,000 acres by co-operation between the park and water-boards, together with several gifts of land.

The landscape situation of Lynn is fortunate. The sea is at its feet, and the ocean surf breaks grandly upon its celebrated beach. On the other side the rocky woodland stretches away, and its irregular, tree-covered promontories come down into the town whose dense mass of houses retreats into the valleys, bringing to mind, when seen from a distance, the sea-waves as they surge up against a stony shore. The rugged hills form a portion of a range that runs inland and forms the northerly rim of the Boston basin. This region resembles the Middlesex Fells in many ways, but in its tree-growth it is far superior to the Fells and the Blue Hills. Nearly every tree native to New England is found here. Mr. Frederick Law Olmsted, when consulted in relation to the place, expressed

LYNN WOODS—GLEN LEWIS ROAD.

great admiration for its natural character, and he said that it offered rare opportunities for those forms of recreation which experience shows to be of the most use to the great body of the people of a city. The entire region has now a genuine forest character, though early in colonial days a large portion was cleared for pasture and tillage, and rude old stone walls run through the woods to this day.

The establishment of seaside reservations, to assure to the people forever the coveted right of free access to the shore, is one of the most important elements in the scheme of metropolitan park improvements. The chief of these reservations is that of Revere Beach, which, contemplated from the first, has just been made possible by the authorization of a loan of a million dollars for the purpose. Therefore the entire beach, for a stretch of over three miles from the bluffs at Beachmont to the Point of Pines, becomes public property. A plan is under consideration whereby the reservation may be extended southward along the Winthrop shore to Great Head in Winthrop at the entrance of Boston bay. A gift of most of the land required is promised for this purpose. This would give a grand stretch of over six miles of ocean shore.

Revere Beach is one of the finest reaches of shore on the Massachusetts coast—a grand crescent of surf-fringed sands with the Lynn Woods and the rock-hills of Saugus for a background beyond the wide green marsh levels. Its accessibility—only twenty minutes by ferry and steam-cars from the heart of Boston, and reached by electrics from all parts of the north metropolitan region—has made it immensely popular, notwithstanding its disgraceful condition, marred by shanties and all sorts of low resorts. These encumbrances will all be cleared away, the Boston, Revere Beach and Lynn Railroad will be removed from the crest of the beach to a new location, and replaced by a sightly oceanside way, with drive, walk and promenade, upon a long, sweeping curve extending the length of the beach.

At Newton Upper Falls is the famous Hemlock Gorge, just acquired by the Metropolitan Park Commission. This scene of extraordinarily picturesque and romantic charm is formed by the swift passage of the river, in falls and rapids, through a wild, rocky gorge, with precipitous banks clothed with a splendid growth of hemlocks, and spanned by the grand arch of Echo bridge, carrying

the Sudbury aqueduct of the Metropolitan water-works. This spot, which lies in the three municipalities of Newton, Needham and Wellesley, is one of the rare landscape sights of the public reservations of Greater Boston. Say the landscape architects: "Whether it be viewed from the high summit of the aqueduct arch, from the low level of Boylston street bridge or from the points of ledge near the Newton Mills, this passage of the river through the rocks and hemlocks presents a scene such as can not be matched in the whole metropolitan district."

PAVING BRICK DISCUSSED BY MANUFACTURERS.

PAVING brick was one of the principal subjects discussed at the tenth annual meeting of the National Brick Manufacturers' Association, held in Atlanta during the first week of December. A number of the leading manufacturers participated, but the attendance was smaller than usual, and the meeting was altogether less satisfactory than in previous years, on account of the counter attraction of the great exposition in Atlanta, in which members of the association were quite naturally very much interested.

The election of officers, which occurred at the opening session, resulted as follows: President, R. B. Morrison, Rome, Ga.; first vice-president, G. M. Fiske, Boston; second vice-president, R. C. Penfield, New York City; third vice-president, Edward Orton, Jr., Columbus, O.; secretary, T. A. Randall, Indianapolis; treasurer, John W. Sibley, Birmingham, Ala. The place and time of the next annual meeting will be hereafter determined by the executive committee. Invitations were received from Boston and Nashville.

A report of the proceedings of the meeting, so far as they related to paving brick, is given below.

DIFFERENCE BETWEEN FIRE CLAY AND SHALE.

A question was submitted to the association inquiring as to the difference between fire clay and shale. Mr. Fiske, of Boston, in leading the discussion, said:

I commenced work twenty-five or twenty-six years ago in the manufacture of fire brick, so that I am somewhat familiar with fire clays of all kinds, and yet I

could not to-day define fire clay—could not say just what fire clay is. I have never seen it defined, nor have I ever seen any rule put down by which fire clay can be told from clay that is not fire clay. There are varied opinions in regard to what is entitled to the name of fire clay and what is not, and this is especially true, perhaps, since the manufacture of buff brick has come in. Some have said, why, you can not make any kind of building brick with fire clay, and if you make good brick, that proves that it is not fire clay at all; but that does not follow at all, for you can make good brick with fire clay if you only put enough heat under it to burn it and bring it down to proper conditions. But it is true, I think, that there are many fire brick manufacturers to-day who put on the market brick which are not really entitled to the name of fire brick, for the reason that they do not stand a sufficient amount of fire, and there are some building bricks made to-day which in quality are much superior to fire brick, or many of those so-called fire brick which are sold as such. Now, if I was going to define fire clay at all, I should say that nothing is entitled to the name of real fire clay that would not stand at least 2,000 degrees Fahrenheit, and that a good No. 1 fire clay should stand 3,000 degrees, and an extra fire clay could stand 4,000 degrees. Now, in speaking of these degrees of heat I confess I am speaking somewhat at random, because I have never made any practical test in regard to heat they will stand. I know there are methods of doing this, but, generally speaking, a fire brick man does not use enough heat under what they call a fire brick. Now, as regards shale. As I stated, I know very little about it practically. In appearance it ranges in color from a dark brown to a light gray, and in burning there is quite a variety of color as it comes from the kiln. The name shale, or shale clay, has not been known, I think, a great many years. The name itself implies or gives a hint of one of its physical characteristics—that of coming apart in layers. We speak of the brick or stone "shaling off"; that means it comes off in layers or slivers. We know this about shale—that it makes most excellent paving brick. Perhaps if I should say that shale makes the best paving brick, there would be some here who would not agree with me. I know fire clay will make a good paving brick. That has been demonstrated. I have demonstrated it myself in my own factory, for eight years ago I took some of the low grades of Jersey fire clay and made some paving brick and put them down in the streets of Boston, and they are there to-day, and doing good service; but I dropped that line because I found that it would cost altogether too much to make the brick. I could not sell them with any profit. There have been, of course, a great many beds of shale discovered in the last few years. Every little while we hear of a new deposit being found of most excellent shale for paving brick, and there has been a great deal of money made out of this which previously was supposed to be a sort of worthless material, and I suppose, as in other cases, there has been money lost in it, for we all know by experience and observation that there has been a great deal of money sunk in trying to make brick. Some of the unfortunate men would describe shale as the boy did salt, "that it is the stuff that makes potatoes taste bad when you don't put any on," and I suppose some of the unfortunates would say that "shale is a kind of stuff for capitalists to make money out of by letting it alone." [Laughter.] But the real difference in the fire clay and shale is a rather difficult thing to explain. Now, perhaps we could get as near it as any way by this—that a fire clay worthy of the name is almost free from iron, and the shale clay, to be a good paving brick clay, must contain a certain proportion of iron. I believe the average is somewhere in

the neighborhood of eight per cent. iron. The analyses show us that this is true. That is about the way I would describe the real difference—that shale contains some eight per cent. of iron, and fire brick contains none. Now, perhaps what I have said will start the discussion, and some of these gentlemen who know something about shale will give us some practical information about it.

Prof. Orton: I was the one who put that question in, and I did so because I wanted to hear what other people might have to say, rather than because I wanted to give my own ideas. I have a special reason for wanting to get a little light on the subject. A few months ago a gentleman brought in a sample of clay to me and wanted me to make an analysis of it. Subsequently I had the analysis made by one of my boys, and as I happened to know where the gentleman got this clay, and to know the geological formation from which it came, I reported the result of the test and said that it was a very fair quality of shale, and that under proper treatment it would make a very fair article of the wares which he wished to produce. He came back to me and said that was not what he wanted me to say. He wanted to make a little change in the product of his factory, and to make something out of this shale that he had never tried before. His fellow-craftsmen had condemned his shale as being unfit for this purpose because it was a shale, and he wanted to show that their statement was not true. He said to me: "If in your opinion this material will stand a good heat and give a good, strong article of ware, can't you write a statement and say that that material is fire clay?" I told him that was straining a point. He then said: "What is fire clay?" My own opinion is that it is a very troublesome question to answer at all concisely. I have seen shale which stood an enormous degree of heat, equal to almost any fire clay that I have seen in this country. I have seen records of shale clays and slate clays in Europe, noticeably in Scotland and in portions of Germany, which are taken as a standard of the highest refractory material in the world. The highest number of the Seger cone pyrometers, No. 36, is composed wholly of Silesian shale clay, which requires more heat to accomplish its fusion than any other clay or artificial mixture of silica and alumina of less than kaolin ratio. Of course, I have in my personal experience seen shales which melt at very low temperature indeed; on the other hand, I have seen fire clay melt as easily as any shale I ever saw—at least, they melted so easily that it was a very difficult matter to burn the clay and finish a kiln of it without overburning part of it. At the same time any fair quality of fire clay ought to stand a great deal of fire; yet we have all seen deposits which were a part of fire clay veins, and even mined and sold as fire clay, which, when put into material and burned, would not stand any severe fire. Now, it seems impossible to me to draw the line, from chemical considerations, with any degree of accuracy, and say on this side shall be fire clay and the other shale, because you can not identify one from the other. The typical shale and the typical fire clay are two widely different things, but between these extremes every gradation exists, and one kind merges into the other insensibly. I think the only line you can draw is one of physical structure, and that Mr. Fiske has already alluded to. If the clay spalls off and exhibits a shaly structure it is entitled to be called shale, whether it burns light or dark, and if the clay has the physical quality of fire clay, especially if it comes in a geological formation where fire clays are due, and are found in surrounding territories, I think you ought to call that fire clay.

Mr. Eudaly: If a piece or portion of clay was brought to you thoroughly pul-

verized, so that its original physical condition is entirely destroyed, can you, by analysis, tell whether that was shale clay or not?

Prof. Orton: I do not think I could. I would undoubtedly say, "From the result of the analysis this material is likely a fire clay," or "likely to be a shale clay," according as the composition is like the type of one or the other. I think the geological position and the physical structures are the points which must decide the question.

Mr. Richardson: This highly refractory shale you speak of is a light color, is it not?

Prof. Orton: There is very little of anything in it but silica and alumina; practically, it has the composition of kaolin, but it is a shale structure, and is called a shale clay.

Mr. Richardson: Do you not think that a shale would burn a light color if it was of a refractory character?

Prof. Orton: Yes. Still, there is one in the Hocking Valley, in Ohio, that burns a beautiful buff color, and yet if you get it too hot it will turn to a blue color and vitrify.

Mr. Eudaly: We all know that Milwaukee affords an illustration of this last question. They have clays there that burn light in color and burn at a low temperature, but you ask whether or not this is fire or shale clay. The absence of fluxes in the clay determines whether or not it be fire clay. Of course, an entire absence will indicate fire clay, and where there are a number of fluxes, say five per cent., would indicate a clay that is not a fire clay as we understand the term.

Mr. W. S. Purington: There are very few who realize the amount of heat required to burn Milwaukee clay. Not long ago a friend of ours sent us some samples, which we placed right where they would get the most intense heat in the kiln and we burned them with our clay. Our brick came out thoroughly vitrified, and the others were very light, where they wished to get a very rich yellow color. A gentleman in St. Louis, where they have fire clay, wished us to send some of our clay down to be burned with the fire clay brick, and after the trial he made the remark that "there was nothing left of ours when we sent yours back." He put them in the same position that Milwaukee was put in our clay, and when he sent them back they were only a very soft building brick. I repeat this to show you the difference, and to determine whether the Milwaukee clay could be called fire clay, because, when they burn it, it shrinks.

METHODS OF ASCERTAINING TEMPERATURE IN KILNS.

Mr. Butterworth, of Marion, Ind., asked Prof. Orton to explain his methods of ascertaining the temperature of kilns.

Prof. Orton: Well, it is rather a large subject, that of measuring high temperature. The simplest, easiest and most satisfactory method that I know of for clayworkers is a modification of the trial piece system, which I think we have all used ever since we have burned clay. This modification of the old plan is to substitute little cones, called Seger cones, which are composed of clay, silica and feldspar. These three ingredients, when mixed together, simply represent what you have in an ordinary clay—kaolinite, or real clay, sand and feldspathic mat-

ter; so that the Seger cone is simply an artificial clay whose melting point will vary with the composition given to it. The old trial piece melted when the ware melted. The Seger cones can be made to melt at any point you desire, and so give you warning of the probable effects of the heat on your kiln of ware. While this is the simplest and easiest way, it is not a measurement of temperature; it is simply a measurement of how far the heat has progressed. A few trials will demonstrate the relation between the ware and the cone, and it thus becomes a sort of pyrometer. They are making now electric pyrometers, with which they claim they can measure one degree. I have never had an opportunity, so far, to experiment with any of them. Then there are optical pyrometers, but they are not trustworthy for high-class work. But these little cones are of the same material as your wares. I have started making them myself for my own use; they are not at all difficult to make. Any of you can make a set of cones for his own use by taking your own clay, grinding it very fine, and add to separate portions of it increasing doses of silica to make it harder to melt, and increasing doses of feldspar to make it fuse easier.

Mr. Pike: Can the fusibility of clay be determined by analysis, or must that clay be burned, as you suggest, with cones?

Prof. Orton: I think the analysis of the clay is undoubtedly able to give some sort of an idea of what that clay would do in burning; but I would never be foolish enough to stake any matter of importance on the results of an analysis alone. [Applause.]

Mr. W. S. Purington: All that little cone has to do is to stand up there under its own weight. It has no weight on it whatever. Now, we have in our early stages melted brick in the first six courses—all out of shape—whereas the top brick, which have no weight on them, would be all right. What about finding the melting point by the burning part of the cone?

Prof. Orton: The difference between fusing and vitrification is simply this: they are simply stages of the same process, and the only way to draw a line between the two is to assume that the point of fusion is where the body refuses to hold up its own weight. When a brick begins to topple over that brick is fused. These cones are in that condition. Now, brick in the kiln are differently situated, for they not only have to hold up their own weight, but those above them. Hence they will lose shape and be only vitrified, because it is the weight which deforms them. If subjected to equal heat, without any weight, they would not have bent at all.

Mr. Purington: The only point I was getting at is, how can you find out what kind of cone to use?

Prof. Orton: Use a cone which fuses at a temperature where your clay merely vitrifies nicely.

Mr. Taylor: When I read this question I thought I saw a way to the solution by a little matter that happened to me about two months ago. I was asked to go up into the state of New York to look at a brick plant and see the brick, and whether I thought it worth while to continue the operations. In looking over the yards and sheds I saw that many brick were covered all over the surface with very fine cobweb cracks. I said to the superintendent of the yard: "How do you account for that?" He said: "We did not get quite enough clay into our shale." I said: "Then you have clay, as well as shale, in your yard." I said I would like to go out and look at the clay bank. He took me out to the shale bank, and down at the

bottom of the slope of their bank, where they had been digging, there was a lot of very sticky mud. It was the shale simply disintegrated by the effects of the climate. Now they were in a hole; it was shale, only it had washed down to the bottom, but it was shale still, and I thought that is just about how it was with Brother Ittner's coal slack. I was in the hole with Brother Ittner; I did not think it made any difference—soft or hard coal slack—and Prof. Orton has fortified me in my judgment. He told us that he has seen shales that would stand the highest temperature, and I know he has seen clays that would stand nothing in the way of heat. I want to ask a question that will set our brothers thinking—not as scientific men, but as practical men. Would it not be practical for us, as brick-makers, to decide what to call fire and what to call shale clay? And my idea is this: For myself, it would be that no clay should be called fire clay unless it would stand a greater heat than iron. About the lowest grade of fire clay we have is used for linings for our stoves, and I claim that any clay that will make a serviceable lining for a cook stove is a fire clay, just as much as the highest fire clay that is made—not the same quality, but still a fire clay. I do not wish these remarks of mine to be taken as authorities.

Mr. McAvoy: Mr. Taylor said that these brick were full of cracks. Now, I would like to ask him whether these cracks were made before the brick entered the kiln or after they were burned?

Mr. Taylor: I can hardly answer that question. I do not think it a fair one. I merely gave you the facts as they occurred to me. The superintendent of that yard thought he had two materials, and that one was shale and the other clay, whereas it was the same material under different conditions. We are not discussing imperfect burning, but if the gentleman is asking for information, I think it was because of the introduction of clay direct into the kiln from the machine.

Mr. McAvoy: I use a clay as well as shale. My experience is about this: Cobweb cracks are caused in the drying process. They are found where the brick are hacked in the wind. It occurs in the drying; wherever the brick are hacked in a strong draft, there will be cracks in the brick. Where we had the same clay, and put those brick through a steam drier, and then into the kiln, we had no trouble.

Mr. Taylor: I must beg to differ with friend McAvoy, because those brick that I am referring to were never dried or hacked in the wind. They were dried in a drier; they were dry pressed brick.

Mr. Ravenscroft: I do not believe a shale that has to be blasted should be called a shale at all. Therefore, I think Mr. Taylor's idea that clay that has to be blasted should be termed shale would be misleading.

Mr. Haeger: I have neither fire clay nor shale clay, but I make common brick and drain tile. What is the distinction between fire clay and shale clay? I would say that a fire clay is a clay that is refractory and remains porus under a severe heat, and a shale clay I should call a clay that will fuse under a medium or extreme heat and become solid, and with which they can pave streets. That is my idea of these two clays.

Mr. McAvoy: Mr. Taylor said that these brick were not put through a drier, but that they were made by the dry clay process. I want to say to you that the moment those brick were taken from the machine and put into the kiln they were put in there to dry, and they dried too rapidly, and that is what caused those cracks.

Mr. Eudaly: I find there are many plants burning pavers that require a

greater degree of heat than is required in a majority of fire clays. You are burning brick for different purposes, and it is a wrong idea. Some of our best fire brick manufacturers are not using as high a degree of heat to burn their brick as is used at Galesburg, Canton or other places where they burn pavers.

FIRE HOLE OF MULTIPLE STACK DOWN-DRAFT KILN FOR PAVING BRICK.

One of the questions submitted for discussion was: "What type of fire hole can be used to best advantage on the multiple stack down-draft kiln for paving brick?" the discussion of which Mr. Snell was asked to lead.

Mr. Snell: Notwithstanding that I do not know anything about this question, I am willing to take the position of the fellow in the football game who throws the ball in to see the rest tumble after. I have had very little experience in connection with the multiple stack. We use a kiln in our yard where there are eight kilns connected with one stack. That was originally started by a man who had a hobby and tried to build a kiln after his own idea, and when he got it half done he got tired of his hobby, and the rest of his company got tired of him. It is not a continuous kiln, or anything else, but it was the only one that I have had any experience with embracing the multiple stack. In connection with that we use an ordinary fire box, with a grate, with an opening through the wall, and we built up a wall of fire brick on the inside, because our brick melt, warp and run; but that is all that I can say about it. My experience will not be worth anything to you in that way.

Mr. D. V. Purington: I suppose, when I read that question, that it referred directly to the passage from the furnace to the kiln.

Mr. Ittner: I would suggest that in this question we regard the words fire hole to mean a furnace, and in which combustion takes place.

Mr. Eudaly: To make it doubly sure, let us know what is meant by the multiple stack, because I am inclined to think we will get started wrong.

Mr. Ittner: Don't you think it means by multiple the entire system of the stacks?

Mr. W. S. Purington: It was rather intimated to me that I would be called upon to answer this question, and I asked every one around me here what was meant by multiple stack, and no one seemed to know.

Secretary Randall: I suppose it meant a kiln on which more than one stack was used, and I think there are a number of such kilns.

Mr. W. S. Purington: Well, the question in regard to the best furnace for burning coal I am not able to answer, and I can simply give you our experience in regard to the furnace, which was intended originally for grates, but a short time ago we had an idea that we could burn without them. There was a neighbor of ours who is using a different style of kiln and was having good results in one particular, and we saw that there was no way through the firing to injure the brick at all, and as they claim they made so much tougher brick than ours I thought I would find out how they did it. I found they were using two holes, one

above the other, the upper hole a little smaller than the other, which is about 8 x 12 inches, and had no grate bar whatever, simply got the clinkers out through the wall and left the ashes lay, except where they pulled them out to the front of the opening. Our results have been so good and satisfactory that we have abandoned our old standby oil and are using coal entirely, except for drying purposes. The combustion we have is about as complete as we can get it, and we can regulate our fires and there is very little to be done after the kiln gets warmed up. We had previously tried burning with the grate bars and we gave it up entirely because we could not get a brick to meet the demand of the people we had been supplying with oil-burned brick. Now we are burning a brick equal if not superior to the brick burned with oil.

Mr. Eudaly: Now, in reference to the number of stacks you are using on these kilns of yours.

Mr. Purington: Well, we are using the multiple stacks. [Laughter.] Two stacks, one on each end, with a center flue.

REPRESSING PAVING BRICK.

Two questions were submitted relating to the repressing of paving brick, as follows:

"What is the benefit of repressing so far as the structure of the brick is concerned?"

"Does repressing a brick make it more durable?"

The president asked Mr. Sibley, of the Coaldale Brick and Tile Company, to lead the discussion.

Mr. Sibley: Mr. President, I will put the cart before the horse and answer the last question first, "Does repressing of brick make it more durable?" I think it will certainly make it more durable. My experience has been mostly with shale, and we have found it to our advantage to repress our pavers, both for the reason that our market demands it and because we can make a better paver. We have had no trouble whatever in the brick mashing, and I think those of you who have a sandy clay will find it a great benefit to repress it. Down in this country all of the city engineers call for brick with the round corners and beveled edges, and so far as I know we have no apparatus to put them on the brick but the repress.

D. V. Purington: It does not seem to me that the man who asked that question had any need to ask it. Repressing a brick does make it more durable and makes it better in every way.

Mr. Ittner: What is the benefit of repressing it so far as the structure of the brick is concerned?

Mr. Purington: It makes every brick of uniform size and weight.

Mr. Ittner: Not uniform weight?

Mr. Purington: It makes every brick of uniform size and weight; I hope you understand me.

Mr. Ittner: It can not be true.

Mr. Purington: Perhaps when I tell Mr. Ittner that these repressed brick are

made from a common brick of the same size he will understand the brick are of equal weight.

Mr. Ittner: I did not think of that at the time.

Mr. Pike: Tell us why the brick are better.

Mr. Purington: Because, as Mr. Sibley has stated, no machine has been made that will make the round corners or edges. I think the demand is growing for paving brick with round corners, and by repressing you can make good brick with round corners or edges. The time is coming when every paving brick manufacturer will have to come to it. The brick will have to be repressed.

A Member: Do you know where you stand now?

Mr. Purington: I know we are not making any money.

Mr. Crafts: Are these round-cornered brick good for building purposes?

Mr. Purington: I did not say that. I am willing to grant you the privilege of taking it that way. They are good for something. We have been building a stack of repressed brick, and I want to say to you that the round corner is hardly perceptible. A quarter of an inch fillet does not interfere with the appearance of a wall of common building brick.

Prof. Orton: You say it makes the brick more durable. What is your opinion about the structure of the brick?

Mr. Purington: I will tell you more about that when we get through the experiments being made by our committee. It is a question whether an end-cut will make as good a repressed brick—whether it is not going to do more injury to the brick than a side-cut brick under the same circumstances. I am sometimes inclined to believe that a side-cut brick, repressed, sustains less injury than an end-cut brick. Of course, you will understand, some of you men who have been in that particular line of business, that to put a green brick into the die for repressing, it must be considerably smaller than the die, or else you can not slip it in without taking time to do it. When the plunger of the press comes upon that piece of clay there is no doubt but that the whole structural formation of the brick is changed. It tears it all apart. Now, whether that makes a homogeneous mass as much as before it was pressed is the question.

Mr. McAvoy: My opinion is that it does not.

Mr. Purington: My opinion is that if sufficiently pressed it will.

Mr. Eudaly: I was just going to make a suggestion along this line. I can not see how, if the clay is thoroughly ground up, so that the physical condition of the clay should be changed, and is tempered and put to the machine—an auger machine or a stiff clay machine—and immediately placed in the repress and pressed, I can not see how the repressing machine can affect the structure of the brick. I can not see how that is possible.

Mr. Purington: In all auger machine brick there are laminations—is that not true?

Mr. Eudaly: I am not saying whether it is or not. But I do not believe you can demonstrate it. I think the laminations largely come from the improper preparation of the clay. I have seen auger machines in which you can not find a sign of laminations. Suppose there are laminations. Suppose your clay is partly ground, and if the brick is placed immediately into the repress, how can it affect the structure? If the clay was placed in the press after being wet and allowed to set for a time—that is, time enough for settling or drying—and is then placed in the press, the pressure undoubtedly would destroy the structure of the brick.

But if the clay is properly prepared and put into the machine, and immediately repressed, I do not see how you can destroy the structure, for from the time you start the clay from the bank through the machine, no matter what process, the structure of the clay is being changed, and if it goes immediately from one change to another I can not see how it is going to be damaged.

Mr. Purington: I do not think it is damaged, but it is changed—the form is changed. You run it through the machine, and the dies won't change its form.

Mr. McAvoy: The reason why we claim that it destroys the structure of the brick is that if it comes through at a pressure of 30,000 pounds it will change the structure.

W. S. Purington: What is the benefit of repressing? The benefit is largely and almost entirely derived from being able to pass your brick at the place where they are being laid, as above common brick. They look better; they sell better. That is what we have found. Mr. Sibley stated that it made the brick more dense, but I do not believe it possible for us to make a machine to condense those brick to such an extent that you can measure them in cubic inches. I do not think there is any necessity of making a machine for pressing them so hard as a dry pressed brick. What I think is necessary is the shape. I am sorry that the committee appointed by the association a year ago to carry out a series of tests have made one mistake—they may have made more; I don't know. [Laughter.] They say they are going to make the main test a rattling test, and that they are going to rattle square brick in competition with repressed. In the instructions given me to rattle these brick, both kinds are put in together. I think this is one of the special points of the whole business, and the only way you can be able to tell the relative value of the processes of manufacture.

R. C. Penfield: In speaking about the change of the structure of the clay in repressing brick, I would like to say that you have all seen how they take a ball of clay to make a sewer pipe; that clay has been pressed roughly into a ball by the packer connected with your real pressing chamber. Here the piston descends and forces the clay to undergo a much more severe change of shape than occurs in making any brick. I can not see why there is so much talk of changing the bond of the brick; it seems to me a great deal like taking a bag of shot and pouring it from the bag out into some other kind of a vessel; you change the shape of it but the little shot all stand practically in the same relation as before, but in a different form. I do not think the repressing will materially change the structure. I can see very plainly that if you take a brick and repress it after it has set and become partly dry, and attempt to form it into another shape, it is natural that you change the brick and destroy the bond of your clay and injure it. The same thing might happen if you were working your clay very, very stiff. But if it is very plastic and the clay is in a proper condition, and you run it through an ordinary repress for the purpose of rounding the corners, I do not think it injures the brick in any way.

President Morrison: Mr. Purington said the rattling test was the main test. I think the absorption test is the main test.

Prof. Orton: What Mr. Penfield says is true. The clay does go through a tremendous pressure from the time it goes in as a ball until, as the finished pipe, it comes out, but there is one condition in the sewer-pipe press which he will readily see is not present in the die-boxes of many repress machines for brick. There is a large number of small tissue holes, and the reason the clay comes out

so nicely and without any detriment to the structure of the pipe is because of the large number of small openings where the clay and inclosed air can get out a little at a time. I think the whole point of the repressing comes in about here. If you make your press-box of the neat shape and size of your brick, so that they will fit into it, I do not think it will make very much difference in the structure. But if you have to expel some clay, then the issue holes make a vital difference. I have seen lots and lots of brick spoiled because when the pressure came on there was no adequate place for the surplus clay to be expelled and the whole surplus was ejected from one or two large holes instead of many small ones, and this results in flaws and cracks in the brick in nearly every case.

R. C. Penfield: It seems to me we are laboring under misapprehensions in regard to repressing paving brick. If you want a perfect paving brick you want a brick that will slip from the press very easily; consequently you do not want a press that will expel a portion of the clay, but one which will compress it all, perfectly filling the mold with just what you put into the press. I do not think that the compression has anything to do with changing the structure of the particles of the clay, and after you have pressed your brick you will find the particles of clay just the same as you did on leaving the auger machines.

SALT-GLAZING OF PAVING BRICK.

A discussion on the question "Does salt-glazing make a paving brick better?" was led by Mr. W. D. Richardson.

Mr. Richardson: I have never salt-glazed paving brick, and have never observed the effect of the wear on salt-glazed paving brick in the street, neither do I think I ever remember but once of seeing a street paved with a salt-glazed brick. There may be men here who have a salt-glazed brick and have made these observations, and if so, it would be better to have them talk on this subject. However, the salt-glazing of brick and clay ware is so well understood that I have never thought it worth while to make any experiments upon the salt-glazing of paving brick. The advantages or disadvantages of salt-glazing are all on the surface, and can easily be investigated by anybody upon any article of salt-glazed ware without the testing of the salt glaze on a paving brick. There is no question, of course, but that a salt-glazed brick is smoother and prettier to look at, and if put in the street looks very fine. There is no question but that salt-glazed paving brick is easier to be cleaned than a common paver. Of course, it can not be compared with the asphalt paving, so far as being easily cleaned is concerned. What is demanded of a street paved with brick is durability. That is what to some would seem the most important point of this question—whether salt-glazing would make a paving brick more durable, and perhaps some might think it would make it more impervious to moisture, and that would be an advantage. But we all know that a well-made paver, and especially a shale paving brick, would not absorb enough water to be of any disadvantage, and this fact is becoming so well known that a great many engineers do not make a test of absorption at all. They know the absorption is so little in a vitrified or well-burned shale paver that there is nothing to be feared from the absorption of water in brick. A salt-glazed

brick, while not wholly impervious to water, will not absorb quite as much water as a brick that is not salt-glazed.

Mr. McMillan: I want to ask if salt-glazing would not make the brick more slippery.

Mr. Richardson: That is one of the points I would mention as a disadvantage. Oftentimes we have to meet this question. In the city of Cleveland nearly all the paving is done with Medina sandstone. Of course, the salt-glazed brick is slippery as compared with sandstone, and that would be one of the disadvantages, though they are not slippery as compared with granite or asphalt. Now, if you make salt-glazed brick they will be much more slippery than without the glazing. I heard a few years ago, when this question was being discussed by engineers, that they objected to salt-glazing because it covered up the defects of the brick, and you could not tell whether the brick were hard-burned. Now, you know, you can not get a salt glaze upon a brick or other ware unless it is hard-burned, so that would not be a great objection. I, myself, do not believe in salt-glazing brick, so I am speaking only from one side. If there is any one here who has been salt-glazing brick and thinks it makes the brick better, I would like to hear from him.

Mr. Purington: The concensus of opinion, so far as I know, is decidedly against salt-glazing paving brick. I believe that nine out of ten of the members of this convention do not believe in salt-glazing paving brick, and unless there is some one here who has faith in it, I think we had better go on to the next question. I want to correct one remark Mr. Richardson made, and that is that asphalt is neater and cleaner than brick. It does not begin to be as clean or neat or healthy as brick. Under no circumstances is there any dust arising from the brick pavement, and I do not want any member to take that position.

Secretary Randall: On that score I want to say that in our city we have twelve or fifteen, maybe twenty, miles of brick pavement and a still larger mileage of asphalt. I am a bicycle rider, and I know something about the condition of our streets. A brick street is superior to asphalt in almost every way. There is nothing more unpleasant than an unswept asphalt street. The dust from it is unhealthy and destroys furniture and draperies. It is hard on horses—almost as bad as granite, and when you sprinkle them they are well-nigh impassable, especially in freezing weather. Most all of the serious accidents that happen to bicycle riders in our city occur on wet asphalt pavements. I regard the asphalt pavement as being less advantageous in many respects than brick. It is less durable, more expensive and not as good a street to drive over a large part of the year. My office faces an asphalt street, and for the next three months, whenever it rains or snows and freezes, the street will be almost impassable. Horses can scarcely stand upon it, let alone pull a load, the pavement is so slippery. It takes but little of that kind of experience to convince one of the superiority of brick over asphalt.

Mr. Taylor: I rise to ask a question. I want to ask whether it is possible to salt-glaze paving brick in a way that they will not stick together in burning. I know that in salt-glazing drain pipes, where the two ends come together there is no glaze, and in burning paving brick you burn them face to face, and I do not think you could very well make a salt-glazed paving brick.

President Morrison: Mr. Purington stated that nearly every person knew that it was better not to salt-glaze brick. I wish to know why this is. What is the objection to the glaze?

Mr. Purington: In my judgment the only man who glazes his brick is the one whose material is poor, and he glazes his brick to cover up some defect. That is my experience. They are usually of a low-grade material, and when they are glazed you can not tell until you break open a brick whether it is good for anything or not, whereas, with an ordinary brick without the glaze, you can judge the quality of the brick almost by its appearance.

C. I. Holman, Sergeant Bluff, Iowa: I do not understand that salt-glazing is at all a detriment to the brick. I salt-glazed the first paving brick I ever made. I put fourteen thousand in a little potter's kiln that had been burned for a great many years, until the inside of the kiln was covered with the glaze, and when those brick came out they were pretty well salt-glazed, and these were absolutely the best brick I have ever burned for paving brick. I put them down in Sioux City, and they are still there, and show no wear whatever. Now, I claim those brick were not at all injured by the salt-glaze. I have never seen salt-glazing put to a test. In my own place I generally salt a little for the first one or two burns in the kiln, and it shows on the brick a little. I do not think it does any harm. Those brick took the salt from the kiln to quite a considerable extent, so it showed on the brick. My idea of burning a paving brick settles down to this: About the best description I ever heard of burning a paving brick was by one of our Iowa brickmakers. He said: "You want to burn it within an inch of its life, and then stop."

Mr. Pike: I think, without having made a test, that the glazing of brick would be detrimental, because we know that salt is damp, and at the time this salt is applied—if the salt is put in at a time when the heat is at the highest stage—you throw a dampness into that kiln. It has a tendency to glaze the surface of the brick and you must certainly injure the brick, and for that reason I think it detrimental.

STANDARD SPECIFICATIONS AND METHODS OF TESTING PAVING BRICK.

Prof. Edward Orton, Jr., secretary of the commission appointed a year ago on standard specifications and tests of paving brick, submitted a report of the work of the committee since their meeting in Indianapolis in last August. He said:

It was, perhaps, a mistake that the commission did not meet earlier in the season, as the time intervening between the meeting in August and the date of this convention has proven all too short for the work which we have undertaken. However, as the mistake is a matter of the past, I need say no more on that subject. The experience of each of us has been that the work which has devolved on him has magnified itself very greatly since it has been undertaken, and while a great deal of work has been accomplished, I am sorry to tell you that it is not completed in any department. The subdivision of the subject was substantially as follows: To Mr. Beahan, of Streator, Ill., was given the most important subject of absorption; to myself fell the subject of the abrasion test; to Professor Wheeler and Mr. F. F. Harrington, of St. Louis, fell the subject of crushing and cross-breaking. These gentlemen are not regularly constituted members of the

commission, but as they are experts in their line, and as they came forward voluntarily and offered their services in this connection free of cost to the commission, we feel that we have done wisely in accepting their co-operation. To Mr. Purington, of Chicago, has fallen one of the most important tests, that of determining the influence of structure of the brick on its wearing qualities. This is a line of investigation not directly contemplated by the resolution authorizing our work, but as it bears so directly on all of the points involved, we have seen fit to begin experiments looking toward its solution. Mr. Beahan has completed partially the work entrusted to him. I have assurances from the St. Louis gentlemen that their work is also in hand.

Mr. Purington has attacked his subject with characteristic vigor. He has at this time completed at least one-half and perhaps two-thirds of a series of tests, which I think bids fair to throw more light on the problems of brick manufacture than any series that we have undertaken. I will outline roughly the line of experiment which he has undertaken. He first obtained a large quantity of clay of strictly uniform quality and character by mixing a number of tons of ground material coming from his dry pans, tempering the whole as one large batch, and thoroughly mixing as fast as tempered, so that all portions of the batch would be equal. This tempered mass he then barreled up, packing the clay tightly into each barrel. Three barrels of this he sent to parties in various parts of the state of Illinois and adjoining states, to points where machinery was being used which represented all the characteristic types of manufacture. Each kind of machine was capable of imparting to its brick a definite and characteristic structure, and a structure which represented a type largely found in actual use, was incorporated into our list, and as a result Mr. Purington now has a large number of brick manufactured by a large number of different machines, and still each set of bricks has in it only the single element of variation which the machine has imparted, for the clay, the tempering and the drying are all uniform throughout. The last step in the process will be the burning, which is now in progress. These various batches of brick have been put into one kiln, into one part of one kiln, and shielded from the direct effect of the flames, so that as near as it is humanly possible they will be subjected to absolutely the same conditions. Therefore, when his brick are finally finished we will have a series of brick in which no condition has been permitted to vary, except that of structure. This brick will then be tested by all known means, and the effect of structure, independent of other varying causes, will be thus deduced. As I said before, I can not express too strongly my view of the importance of this work.

My own report on the abrasion test is similarly incomplete, but I will give you enough of the results attained so far so that you can see at least what the scope of our inquiry will be, and also that you will see that we are determined, if allowed to do so, to make our work very thorough and painstaking. It seems to the commission, and I hope that it will commend itself to the judgment of the convention, that this work undertaken by us should not be of a temporary or partial character. We do not wish to publish officially tests which purport to have covered the ground inexhaustively, and then allow some civil engineer or other person engaged in this work to point out inaccuracies or weak points in our argument, and it will amply pay the association to spend enough money and enough time to find out the truth before we take any definite stand in the matter.

In making the abrasion tests the first thing looked to was to secure a batch

of uniform brick; for in this standardizing work it is the brick which are assumed as the standard, and it was the machine itself which is really to be tested. After the machine is established, of course the machine is the standard and the brick are to be tested, but in this first case the work is reversed.

Accordingly I sent notice to a number of our prominent brick manufacturers in Ohio, stating that I needed a large amount of brick selected under conditions of absolute uniformity, and stating the purpose of my request. I was favored with a prompt response from the Canton Brick Co., of Canton, offering to give us whatever quality of brick, within reason, we needed, and that I should have carte-blanche to select them as I saw fit from their kilns. The brick were taken from a large kiln in a compact body, ten courses deep, two courses below the top and sixteen courses above the bottom. It was separated from the end of the kiln by seven courses, and by five courses from the nearest bag on either side. So you will see that it was almost impossible that this lot of brick could have been subjected to very much variation in temperature of firing or rapidity of cooling, and if it is possible to make uniform brick these brick should be uniform. A car load were so selected, shipped to Columbus and piled up in my laboratory. I think a public expression is due to the Canton Brick Co. for the generosity with which they have responded to my call, and that the association is indebted to these gentlemen. After obtaining the brick, the next question was a standard rattler in which to conduct the tests. I had one built according to the provisional standard adopted by the commission in August, except that I made its length double that recommended by the commission, and in the middle I put a movable diaphragm one inch thick, of iron, which, when placed in the middle, gave me a double rattling chamber, each of standard size, but by moving this diaphragm I could secure a chamber of any desired length.

The first test undertaken, which we will designate as Series I, was designed to find out how many brick it was necessary to use to obtain the greatest abrasion in the rattler. In other words, is the abrasion in a small charge of brick as much as the abrasion in a large charge of brick, and if so, how small may the charge be made and still maintain its largest rate of loss? In order to get at a systematic basis of calculation in this matter, I computed the cubic contents of the rattler in inches, also the average cubic inches in each brick, and then weighed out a series of charges in which the volume of the brick bore a definite relation to the inside contents of the rattler. Thus, the first charge was 5 per cent. and the second 10 per cent., and so on up to 40 per cent. These charges were rattled a standard time at a standard speed, and their losses by abrasion calculated. The treatment was then repeated for a second standard time and standard speed and their abrasion computed. The results have been duplicated. The result has thrown a flood of light on this much-vexed question. We find from the data so obtained that the variation in loss is much less affected by the volume of the charge than we had supposed; that a small charge loses less than a large charge, because of less frequent opportunities for impact and abrasion, and that very large charges lose less than medium charges because of crowding in the cylinder and insufficient opportunity for long falls or hard blows. The losses sustained by charges between 10 per cent. and 25 per cent. show comparatively little change.

The second series of tests, or Series II, was designed to show how long it is necessary to rattle a charge of brick in order to produce the proper degree of abrasion. All of you know that a charge of brick loses more heavily in the first few moments than in the latter part of a period of abrasion. To get at this point

I rattled four sets of samples of different cubic contents each, for eight consecutive ten-minute periods, weighing carefully after each operation. The results showed exactly what was anticipated, namely, that the abrasion is greatest in the first ten minutes, less in the second, less in the third, and so on to the eighth. The first losses are mainly by chipping, the last losses are mainly by wearing. The problem is, therefore, to find out how long it is necessary to carry on this process in order to get a measure of the tendency to wear as well as the tendency to chip. Our results, when plotted in curves, will enable the committee to make a specific recommendation on this point.

Series III was designed to find out whether, if all other conditions were kept uniform, the length of the rattler really exercises any effect on its wearing power. As in actual practice engineers are compelled to hire foundry rattlers of all sizes and all lengths, it has, in the past, been an element of constant variation. In order to obtain a measurement as to the effect of length, apart from other conditions, I conducted several series of tests on charges of various volumes, in which the length of the cylinder was varied from 12 inches up to 48 inches by the use of my movable diaphragm. The shortest cylinder, 12x28 say, gave less regular results than those which were longer, because of the tendency of the brick to wedge endwise. But from 18 inches up to 48 inches in length (the diameter being always constant) the wear was substantially uniform for all sizes, showing that if the percentage of volume of the charge and the time and the speed be maintained equal that length cuts no figure.

The fourth series attacks a problem which is one of the most vital elements of difference in all previous rattler tests; the matter of speed. None of us have been able hitherto to see that the results attained by one man have borne any direct relation to the results attained by another, because the speed of revolution in so many cases has been unequal. In order to get at this point I secured a set of pulleys ranging from 12 to 34 inches. I rattled a series of charges of different volumes for forty minutes at each speed, and I also rattled the same charges for periods of one thousand and two thousand revolutions, weighing after each. The results of this work in brief show a most important point and one which has been argued pro and con; that is, that the loss varies with the number of revolutions much more than with the time of the revolution. It does not matter so much what the speed per minute is, if the bricks are subjected to a uniform number of turns altogether. The results of the test when plotted and carefully worked over by the commission will enable them to name the proper standard speed and will also enable them to say within what variations tests may be accepted for comparison, when they are not made under the actual standard conditions.

The fifth series undertaken was to show the effect of differences in diameter of the machine, all other points being maintained equal. The first four series of tests were all made on my own machine at the laboratory of the Ohio State University, but the fifth series could not, in the nature of the case, be executed in one machine. I was obliged to go among the foundries and machinists of Columbus, and rent for short periods the use of machines of all different sizes which I could find. In the course of my work I unearthed not less than seventy-five or one hundred different rattlers, and found them to be divided substantially into two classes, the small ones having diameters from sixteen to twenty-two inches, the large ones having diameters from twenty-six to forty-eight inches. Between these two sizes the twenty-four-inch size was wanting in Columbus, and to obtain a measurement on this size I was obliged to send my sample to St. Louis. How-

ever, my results are obtained on as large a range of size as can be found in any ordinary city, and larger than will be obtained by any engineer in search of a place to do his work. The losses sustained by uniform charges, that is, charges of uniform volume, uniform time and uniform number of revolutions in these rattlers of different diameter, show in brief that the smaller the rattler the less the loss, and the larger the rattler the larger the loss, up to a certain point. Above the diameter of twenty-eight inches no further increase in rate of loss occurs, as the brick exhibit a tendency to slide on the bottom of the barrel rather than go up the side and then drop back with violence.

The commission will be able from these series of results to indicate a standard size machine and also to say within what limits other machines may be used without vitiating the results attained in them. There are still other problems connected with the testing of brick which need very greatly the labor of some one to carry them out. I began two series of tests which I have been so far unable to complete. The object of the sixth series was to show the losses sustained by a uniform number of brick when subjected to the abrasive action of small foundry shot, each piece of iron weighing not more than one and a half pounds, and the average not more than one-half or one-quarter pound. The results in brief show that the loss by abrasion under such conditions is very low, and that the more iron used the less abrasion results.

I next made a partial series of tests, using the standard number of brick and filling in the rest to the standard volume with cast iron brick of equal weight, but much less size than the clay brick. The abrasion produced under this condition was very violent, and the brick as well as the machine suffered greatly. I broke the machine twice in succession in executing these tests, and found that the losses sustained by the brick were very variable and irregular, and that the losses sustained by the machine and the iron were quite noticeable as well. I did not carry this series to its logical conclusion, but went far enough to show that such a test would hardly be commercially practicable on account of its great variability and severity.

There still remain many other questions and problems not yet taken up. The effect of granite, corundum, hard and soft brick and various other filling materials, and the use of a minimum number of brick, with other material to fill up to a standard volume, and the influence of wet brick on dry ones, and the influence of water on brick in its abrasion test, and the influence of large brick compared to small ones, and many other points remaining.

I have merely roughly indicated at this point the results at hand. The tabular information the commission does not deem it wise at this time to officially publish. It is hoped that the convention will have seen from the statements now made that we have undertaken this work with a serious desire to get to the bottom of the problem. If the convention feels concerning it as the members of the commission do, it will be carried to its logical termination as rapidly as possible and the results put forward before the engineers of the country, with full confidence that the entire reasonableness of our position will justify their support.

The commission hopes to be able by March or April, if authorized at this time to go ahead, to finish the series of tests, at least as far as the commoner ones are concerned. And the commission feels that the work it is doing will be of great importance to brick manufacturers. All we have to say further at this time is that we greatly hope the association feels as we do concerning this point and that

they will give us the required encouragement and the necessary financial support for carrying on the work. [Applause.]

Mr. Gery: I move that a vote of thanks be extended by this convention to the commission for the work that has been done.

Motion seconded and carried.

Mr. Richardson: I have a resolution that I wanted to present to the committee on resolutions on this subject at the proper time, and I want to say a few words now on that resolution while Prof. Orton is present. I believe and feel that in these investigations we have taken the most important step in our organization. We have been coming to these conventions year after year and giving individual experiences and opinions upon many of these questions, but we have nothing better than our practical opinions, based upon individual work under varying conditions, and we have gone away still in doubt as to the truth. Now, I feel, and I think many of you feel, that we could go on continuing the discussion of these questions and never get any nearer the truth, and the only way we can accomplish anything is by a series of experiments conducted by parties in an impartial manner. We have in our association men of a scientific turn who are willing and able to carry on these experiments, but it is not right that we should ask them to bear the expense of these investigations. Now, it has been seen in this series of investigations that Prof. Orton has explained to us to-day that, though a man might give his time and labor to it, there are many things in connection with it for which he must pay out money from his own pocket. Now, that, of course, is not right, nor is it expected. I merely make this suggestion that the resolutions committee can be guided by the discussion of the resolution, which will be put in a definite form. The resolution which I am going to submit to the committee on resolutions is: "*Resolved*, That we appropriate $300 toward defraying the expenses of the Committee on Standard Specifications and Methods of Testing Paving Brick, and that the attention of said committee be drawn to the importance of reporting on the size for standard paving brick." This is only one of the problems we expect to take up. What we may all look forward to is that these tests will be continued, and that when this subject is finished we may take up some other matter.

Mr. Purington: I do not think it necessary to say anything now in favor of that resolution other than has been said by Mr. Richardson, but I want to call the attention of the convention to one particular point which Mr. Orton failed to bring out, and that is, that the aim and effort and design of the committee, first and last, has been to get the severest test for paving material. We want a test that any engineer or member of any board of aldermen, or anybody else interested in good paving, can not object to, and we want to take a position that the man who can not furnish the best material wants to get out of the business, and that is the one point we are aiming at, and that is the aim of the committee from first to last.

Mr. Taylor: It is certainly wonderful the education that is contained in that series of experiments and illustrations that we have listened to with a great deal of admiration, and I want to ask a simple question. We are doing these things, of course, to educate the engineers and the general public. Now, would it be practical in all these tests to take a block of granite or sandstone granite, such as is used and recommended for paving, and put them into the same test that the brick stands, so that you could say brick stands a test so much more or so much less than a standard granite that is commonly used?

Prof. Orton: In reply to that suggestion, I thank Mr. Taylor for making it. I had thought some of doing just that thing, but I think you can prove in a more conclusive way to the engineers that granite is not what we want for a standard. We want brick for a standard. [Applause.] Granite is just as variable as any other rock. You can not get granite rock everywhere, and I do not believe in sending all over the United States to get granite to test your clay with.

Mr. Ittner: I want to call your attention to a remark and prediction I made a couple of years ago, that most of us, if we lived ten years, would see other material, especially granite, taken up and replaced with brick. Since that prediction has been made I have seen in the city of St. Louis granite taken up and replaced with wood, and that wood is now rotten, and I expect to see that taken up and replaced with brick within the next eighteen months.

Mr. Eudaly: I want to call your attention to a series of tests made in Cincinnati by an engineer by the name of Burke. Mr. Burke made a test, using granite and several other substances, and the brick stood the best test of all. Mr. Burke has published the results of the experience, and it makes a very valuable book. I have examined that book, and have sent copies to several different cities, and it demonstrates clearly that granite is not a proper thing to test with brick.

COMMERCIAL PHASES OF THE PAVING BRICK INDUSTRY IN 1895.

BY W. BEAHAN, STREATOR, ILL.

"Put money in thy purse."—Shakespeare.

Before writing this paper I deemed it wise to ask leading manufacturers west and east of me what they thought of the commercial phases of our branch of the brick industry in 1895, as compared with 1894. The wise men have, in ancient times, dwelt in the East. You must draw your own inference as to what kind of man dwells to the west of me now. I quote his entire reply, which was this: "1895 compares favorably with 1894, but we are a good deal in the condition of the farmer who had a drouth one year and was drowned out the next." In the light of the last twelve months' experience, I pause here to say that his words seem to me divinely laconic and infernally true. I believe it is a grim summing up of the year's business for factories west of Chicago.

In Ohio the spring trade was not good, but the midsummer and fall business has been very much better, with prices showing a slight improvement. East of Ohio each factory is, as a rule, so located as to depend on local trade, and therefore local conditions rule largely. My opinion is that 1895 has shown greater commercial activity in our business than 1894, but that, as a rule, prices have sagged somewhat. We have been forcing our market. The promised and budding improvement of the early spring has not materialized. We have cut prices among ourselves and have sold too low. Our capacity has given us more output than the market really demanded. This has been disastrous to prices. Beyond a doubt there have been brick loaded on cars at our factories this year at a price that compelled the manufacturers either to lose money or ship brick in the manufacture and grading of which not sufficient care had been expended. Is this wise?

With the general commercial condition of the country this paper has nothing to do. That those general conditions have had their marked effect upon us goes without saying. We are an infant industry passing through a succession of panic years. It is our maiden panic, so to speak. Our modesty is not becoming in a storm. To mix the metaphor, our new whiskers are just beginning to pull, and our first pair of boots hurts awfully. We yearn for rest and warmth, so we've come to Atlanta. We need more arnica and less anarchy.

I think we should be less anxious to manufacture brick we have not sold. Suppose we run our factories on orders and not on prospects. Let us keep nearer home to sell our output. That means less freight to the railroads, and more profit to manufacturers in the aggregate. Suppose we have fewer and better agents. I can name you gentlemen of this last calling who have sold scarcely a brick this year. They have simply put in all their time cutting our price for us at our expense. I want you each to take this fact home with you and talk it over with your wife. Then show her every letter you have received this year from all over this broad land from fellows who want you to pay them $1 per thousand brick for their pull in their town, and their flow of language which is to float paving brick of even high specific gravity and sell your entire output in their burg. Then ask Mrs. Brickmaker where brickmaking ends and bushwhacking begins. Now retire within yourself and ask yourself the classic question: "Where was I at?" After due repentance resolve in 1896 to be eligible in spirit as a member of the N. B. M. A. A man whose influence is for sale has no influence. A man who buys it under any guise is himself sold. Make your brick. Sell your brick. Use no bushwhacking Bashi-bazouk in your business. There is such a thing as city politics. There will be a good deal more of it, and in a rural form and widespread, if you and I do not stop sending such agents lettings as we have sent. An agent who knows naught of the science of selling, save to cut prices, is dear at nothing a year. A really good salesman can sell your brick at your competitor's price half the time, and once in a while at a little higher price. When your new agent begins work by a fusillade of letters for you to "get down" in price, drop that agent.

If a goodly part of the much that should be said in this paper about combining to maintain prices be here written, the convention would adjourn before all the paper could be read. Competition has been the war cry of American industrial advancement. Constitutions hedge us round with safeguards against the untimely death of competition. I am well aware of all this. I am also aware that some years ago we watched weekly the number of immigrants landing at old Castle Garden. We thought then we sadly needed Americans, and were the gainers when they were full grown at the time of their birth—as Americans. Do we think so now? Are ready-made citizens as desirable as once? Is America pining to be inhabited as our orators once believed? No. Times have changed. Our nation is no longer a youth, but is fast reaching maturity. Capital is less remunerative. Wages have greater purchasing power. If prices of paving brick go on downward, it will be by reason of employing labor less American. Shall we go on and drive out English-speaking labor, or shall we maintain such prices for brick that will allow us to pay the father in an American home sufficient wages to raise his family as Americans should be reared? If that be treason to our common country—make the most of it. Competition has made it possible for a dollar to buy too much. We ought to afford to pay better prices for our clothing and—our brick.

I do not say that iron manufacturers combined to advance the price of iron a

few months ago. You have probably said it for me. I do say they voluntarily and promptly and willingly advanced the price of labor in their mills. Do you see any prospect of your being able to increase the pay of your men ten per cent. next spring? Can you do it and load number one paving brick on the cars at somewhere around $6 per thousand? Are you not counting on some way to reduce your rates of pay, rather—by hiring cheap labor? Is the one-time glorious competition of the fathers of the constitution so glorious in the light of present events? Rail at combines as you may, your competition is killing American labor and replacing it with those who speak other tongues—these, in a few years, to be again replaced by something still cheaper. Is the country any better off because of your price competition? Do you not know it is the worse off for it? Granted that $1.50 for ten hours' work is a fair price in your locality, for common labor in your yards, what right have you to willingly manage your business so that you can not pay but $1.25 per day? Is it a wrong to your God or your country to combine so as to maintain common labor at $1.50? Never mind what the press says—what do you say? Is it right to start a cut in prices when you know you must cut your rate of wages as a consequence? Do less for spite toward competitors, and more for the interests of your stockholders and your employes.

Last year, at Cleveland, we all discussed inspection of paving brick in the kilns. Since then we have been doing work on standard specifications and tests. Each is commercially a very important matter, but does not need to be dwelt upon in this paper. I now wish to go one step further and say that, as manufacturers, it does not seem to me wise to be subcontractors in paving contracts. I think we should and could sell direct to the towns and cities which let the work. I have myself consulted excellent lawyers who were themselves mayors at the inception of brick paving in their towns. I learn that in Illinois there is no legal objection to a city council advertising for separate bids for brick and for construction of pavement. We then sell direct and have a contract with the city. In case of any dispute we have a standing in court. We have none now. A contractor not friendly to us, or not actively for us, makes us infinite trouble and much cost sometimes. We are powerless. There are other times when a quarrelsome or tactless contractor will cause brick to be rejected when a different contractor with the same brick and same inspection in the same town is going along smoothly and putting in every brick in the pavement. I would prefer to sell direct. We would have to take bonds. Again, the price of the brick are more than fifty per cent. of the contract. Then let the manufacturer carry his own load and not ask the contractor to put up all the bond, and put up his cash, when city bonds going direct to the manufacturer answer every purpose. Where pavements have to be guaranteed by the contractor, he now has to take his chances of the manufacturer being in commercial existence at the expiration of the guarantee. Contractors take many chances on us which towns could better take. I think it would be better for both contractor and manufacturer to have separate contracts. Each would be taking less risk, and would be in better position to take care of himself. I am confident that under the laws of my own State, Illinois, there is nothing to prevent direct selling of paving brick to cities. How is it in your States?

Such are the salient points, as I see them, in the commercial phases of the paving brick industry the past year. Criticise these points as you will. I care not what you may think about them, if you will only think—then act.

CEMENT AND ITS USE.

DETAILS OF THE SIMPLER TESTS OF CEMENT.

L. C. Sabin, Assoc. M. Am. Soc. C. E.

III. FINENESS.

The fineness of cement is another property which may be determined with inexpensive apparatus. The sieves used for testing are usually of wire cloth, though silk gauze sieves are sometimes employed. They are commonly designated by numbers corresponding to the number of meshes per linear inch. This is in some respects an unsatisfactory method, for the size of the wire, which evidently helps to determine the size of the holes, is either not given at all or is stated in terms of some wire gauge which may be capable of several interpretations. As usually supplied by the manufacturers, the number of meshes per inch may vary as much as ten or fifteen per cent., and the size of the wire used in making a sieve of a given number of meshes per inch, frequently varies quite as much. On account of irregularities in the wire cloth the holes in a sieve are not of uniform size. In some cases one opening is but sixty or seventy per cent. as large in one dimension as an adjacent one. The difficulty of obtaining accurate sieves for use in cement testing has been shown by the writer in a previous article.*

Since there is no proper standard for sieves in this country as regards the size of the holes, the best one can do, after having fixed upon the approximate size of holes desired, is to select a sieve which appears to be uniform throughout and which has the same number of meshes in the two directions at right angles to each other. If it is desired to compare one's results with those obtained by other experimenters it will be necessary to determine, by actual measurement, the size of the holes in the sieve used. But if it is only required to test a given sample it will be sufficient to compare the sample under test with the samples of standard brands which should be kept on hand, as recommended in the first article of this series.

The test for fineness is frequently made with a sieve so coarse that but little information is obtained. Particles of cement clinker larger than about .005 inch in diameter are practically devoid of cementitious properties and are little better than so much sand, yet it is not uncommon to find, in ordinary specifications, the requirement that a certain percentage of the cement must be fine enough to pass a No. 50 sieve. Such a sieve would probably have holes about .011 to .014 inch square, and its use will give us very little idea of what percentage of the product is of value as cement, for many of the grains passing the sieve may be quite worthless.

If the grains in all cements were graded from fine to coarse according to a uniform law, we might then judge of the true fineness from the results obtained with a moderately coarse sieve, but such is not the case. In Germany and America

* Variations in cement testing sieves.—*Engineering News*, June 30, 1892.

it is the common practice, in the process of manufacture, to pass the cement through a screen having about 50 meshes per linear inch; the futility of attempting to determine fineness in the test-room with a sieve no finer than this is therefore apparent. More carefully prepared specifications of the present time usually designate a much finer sieve. One having holes not larger than .005 inch square is recommended (100 to 120 meshes per linear inch), and a few barrels in each shipment should be tested with a still finer sieve. Cements of first quality should not leave a greater residue than 25 per cent. on a sieve having holes .005 inch square.

One-tenth of a pound of cement is ordinarily used in a test for fineness, a scale weighing in ten-thousandths of a pound being used for weighing the residue. Where the metric system is employed (and it may well be adopted in a cement testing laboratory) 100 grams of cement may be taken. If the cement is not perfectly fresh it should be dried before it is sifted; this is especially required with natural cements, since they are more likely to clog the sieve than are Portlands. In using a given sieve one may readily find by trial the time sifting must be continued in order to confine within given limits the error due to variations in time. It will be found that in using sieves having holes between .003 and .004 inch square (approximately 170 to 200 meshes per linear inch), from ten to thirty minutes will be required, natural cements requiring more time than Portlands; for sieves having holes between .007 and .009 inch square (approximately 70 to 100 meshes per linear inch) from five to ten minutes will suffice. The time required is affected by the amount of cement used in the test and the diameter of the sieve.

We may add a word concerning the value of fine grinding and consequent importance of the test for fineness. It has been demonstrated that the grains of cement must be extremely fine in order to have any appreciable value as a cementing agent. In order to obtain the best results each grain of sand must be completely coated with cement, and it is evident that the finer the particles in a given quantity of cement the greater number of grains of sand will the cement cover. Further, in the case of Portland and some natural cements the hard particles will, if ground fine enough, form the best portion of the product. On the other hand fine grinding is expensive, and the limit beyond which the cost of grinding exceeds the increased value of the cement is purely an economic question. This limit is clearly not a fixed one, for if the cement is to be used near the place of manufacture it may be economical to use that which contains a considerable amount of unground clinker, but when it must be transported long distances much more money may properly be expended in grinding and screening the product before shipment, rather than to pay freight on what is practically the same as sand. It is true that cements should almost invariably be mixed with sand in use, but this does not prove that the requirements for fine grinding have been carried too far, as some writers have intimated. The question to be considered is whether it is cheaper to buy cement with a large amount of sand (coarse cement) already intermixed, or to buy cement alone and mix the sand with it at the time of making the mortar.

TESTING AND ANALYSIS OF CEMENTS.

To the Editor of Paving and Municipal Engineering:

Can you advise me as to what is the best book on testing and analyzing cement?

W. ELWOOD SNYDER.

Siegfried's Bridge, Pa.

F. P. Spaulding's book entitled, "Notes on the Testing and Use of Hydraulic Cements," is very good. Prof. Ira O. Baker's "Masonry Construction" has a good chapter on the same subject. There is no short road to the chemistry of cements. Reference to books on analytical chemistry is advised.

ANSWERS TO QUESTIONS.

[By J. W. Howard, B. L., C. E., for PAVING AND MUNICIPAL ENGINEERING.]

Why has wood pavement, even when laid on concrete, proven a failure in the cities of the United States?

N. Y. Inspector.

In answering this it is best to grant that the blocks were carefully cut, with square joints and laid upon a solid concrete foundation of at least six inches thick, and that the joints between the blocks were small and completely filled; moreover, that the wood was well selected and either of a kind that did not need treating with some bituminous substance, or a chemical having a compound of zinc as a basis. Such a pavement was laid on two blocks of Fifth Avenue, N. Y., and on Beaver street on the block north of the Produce Exchange, equal in every respect to the best wood pavement of London—that is, at the start. These pavements failed because of the lack of constant repairs, which are needed upon wood pavements, when subjected to heavy traffic. Repairs in London are made daily. Moreover, these pavements were not kept constantly moist. Wood rots when permitted to be repeatedly soaked with water for a period and then repeatedly dried in the hot sun. In brief, wood pavements such as are used in parts of London and Paris need constant attention by trained men. Nowhere does a "stitch in time save nine," more than in connection with wood pavement. A well-maintained wood pavement of closely-fitted oblong blocks, laid upon concrete, is a luxury, but if kept in order is the most expensive kind of pavement.

Few people realize the immense cost of the wood pavement which they admire in parts of Paris. The existing contracts, when translated into English and reduced from francs per square meter to dollars per square yard, show the cost of wood pavement in Paris, laid and maintained in constant good order during fifteen years to be $12.72 per square yard. It must be remembered that this pays for the constant small repairs and generally two renewals of the entire wood surface, or three counting the first laying.

In London, for a similar pavement the price is, for first construction, $3.40; for maintenance, $3.16; total, $6.56 per square yard for fifteen years. The damp climate of London and a lighter traffic than Paris (although many people think otherwise who have not consulted the recorded statistics), make the cost of wood pavements in London

less than that of Paris. In America, where the pay of labor is more than twice that of Europe, good wood pavements in constant order are something almost beyond consideration. The temporary wood pavements of several western cities serve their purpose, although they often become very uneven, and almost impassable for heavy teams.

Which cities of the United States do paving during the months from November to May? Do these cities also pave during the summer? *T. D. Pierce.*

Because of rain during the above months almost everywhere in the United States paving ceases. Snow and frost stop the work in the north. Some unfinished contracts, begun during the summer or fall, which it is sometimes necessary to finish at intervals, when weather permits, are completed during November and even a little in December. Most specifications, however, are drawn to the effect that "work shall cease on November 1st, and not be permitted to be begun before May 1st, unless in each specifically mentioned case permission is granted by the city engineer, or an equivalent officer." All cities pave during the summer, although for the contractor it is more profitable to avoid work during the hottest season, for paving of all kinds requires much hard hand labor, which is not very efficient in the hottest summer sun. In hot weather concrete foundations need sprinkling. Asphalt pavements should be thoroughly cooled before use.

Is the following requirement customary in the specifications of cities using brick pavements: "No brick or block will be accepted unless it is proven proper by having been successfully used in pavements in some city of the United States for a period of at least two years, and to the extent of at least 5,000 square yards in such city?" *J. E. Bryan.*

This peculiar requirement seems first to have been introduced when Brooklyn, N. Y., and Newark, N. J., in 1895, began experimentally to lay brick pavements. Newark is very conservative, and had paid dearly for previous paving experiments with wood and poor stone. It, however, provided certain tests by which paving bricks could be tried in conjunction with the above requirement or a seven-year guarantee. Such a requirement is not wise in paving brick specifications. It would be wiser to so draw specifications that not only preliminary tests should be made, but that weekly tests during the work should be made, not only upon the bricks but also upon the cement and mixtures used on the foundation. These tests should be made by competent engineers in the employ of the city. These tests should be severe. If the engineers are properly sustained in their decisions the city would avoid the necessity of the above peculiar requirement, which is subject to attack from several standpoints, especially that of competition and the unfortunate factor of "politics."

Does not such a specification tend to discourage building new brick paving plants? (See previous question.) *J. E. Bryan.*

It does, although there seem to be plenty of brick plants in existence, at least sufficient to guarantee competition. Quality is what is needed. No such clause could be inserted in the specifications for the supplies of food, coal or other needs for a county, city, municipality or corporation. It would be wrong to shut out a new farmer from bidding upon supplies to a county poorhouse or a city jail because he had not furnished supplies for two years, etc.

Can you give any information as to the "asphaltina" pavements introduced in——? We have been offered certain rights under patents, but hear they are an infringement on the vulcanite. *A. W. G.*

In answer to this question it is right to state that it is not proper to discuss here questions of patents and infringements. A complete tabulation of nearly one thousand patents, mixtures of asphalt and kindred substances, with other ingredients for tsreet pavements, sidewalks, floors, etc., shows that in general it is impossible to base success in asphalt paving upon patents which have to do with the mixtures used. Moreover, public contracts must be obtained by competitive bidding, and in most states it has been decided that a city can not advertise for bids for a patented article, at least, unless other materials or compositions are allowed to bid in competition with it, whether patented or not. It is safe to say that the great mass of successful pavements of the world, including asphalt, are not patented, nor is it necessary to own or control patents to establish a successful asphalt paving business.

Capital, energy and experience are the factors of the successful problem. Experience embraces not only what prices must be obtained in order to earn a profit, but also guides in the selection of reliable asphalt and supervising its refining, as well as the final mixtures used. For private work not obtained by public bidding certain patents may be an advantage. As to vulcanites, which are mixtures principally of asphalt and coal tar, they can be used by any one. As formerly laid in Washington and a few other places they are failures. It is possible that some asphalt pavement called "asphaltina" has been successful, but is not known as such to this magazine.

In building pike roads, is it safe or advisable to put broken stone on frozen ground? *G. A. B.*

The ground, to be frozen, would contain water, and therefore frozen ground should not be used as a foundation for road construction. If broken or crushed stone should be laid upon a loam or clay soil previously frozen, the result would be in a few months a very uneven road. Even sandy soil in winter time makes an unsafe foundation for building a macadam or telford road.

The word "pike" used in the question is an abbreviation of "turnpike." It is used instead of the name of the material of which the road is constructed, namely, large foundation stone, with crushed stone for a surface if it is telford; or if a macadam road, crushed stone only.

Can flat sheets of steel, or some other structure, be laid in streets for the accommodation of wagon wheels? *Engineer in Canada.*

Theoretically, *yes;* practically, *no*. The best success, however, is in Turin, Italy, where granite tramways are laid flat on the top surface and flush with the adjacent cobblestone and poor granite block pavement. On streets paved in that city with carefully cut granite and with asphalt, the granite tramways are absent. Each piece of granite is about fifteen inches wide on top, twelve inches deep and from six to eight feet long. They are set firmly in concrete, their end joints being diagonal and very close. They are about five feet apart from center to center, and are used not only by the wagons and carriages, but also by street cars which have flat wheels; that is to say wheels without flanges.

The introduction of these granite wheelways would be of no advan-

tage on the interior streets of our cities, because the modern requirements are such that the entire street should be paved as smooth as possible and thus facilitate traffic over its entire surface. But, as at a few points in England and on the continent, such a flat wheelway construction is excellent upon the suburban streets leading to large factories or other points where heavy loads must be drawn. This makes it possible for the rest of the roadway to be covered with macadam, so pleasant for rapid, pleasant suburban driving for light vehicles. The portion of the roadway between the granite wheelways is best paved with granite blocks of small dimensions set with concrete.

A member of our city council desires to post himself on the double and separate systems of sewerage. Please refer me to where I can procure a reliable treatise on the subject. *A. O. Jones.*

Apply to either VanNostrand & Co., or E. & F. N. Spon, publishers, New York. The following books are samples of excellent ones: "Modern Methods of Sewage Disposal," Waring, $2, a popular treatise not technical; "Separate Systems of Sewage," Staley & Pierson, $2; "Sewage Disposal," Wynkoop, $1.25; other and larger works exist and will be named if desired. Sewage is such an important matter, although treated as out of sight, and therefore out of mind, that it would pay every man and woman who aspires to general information of advantage to himself and family, to find time to read one of the above named books. In no case is the adage truer that "an ounce of prevention is better than a pound of cure."

Please inform me through your magazine upon the question: "What should be the minimum grades of 6, 8, 10, 12, 15 and 18 inch pipe sewers respectively, and whether a circular or oval manhole is preferable for pipe sewers?" *J. C. Bates.*

The most important matter in sewerage management is to keep the lines free from deposits. This is a matter depending upon the velocity of flow of the sewage. Experience proves that it is advisable to maintain at least a velocity varying with the size of pipe from 4½ to 3½ ft. per second for pipes up to 12 inches in diameter, and from 3½ to 2 ft. per second for the flow in pipes of larger sizes. The velocity, other things being equal, will vary with the grade. Hence, it is important to determine the grades which are proper to use. The following represent the least grades that it is perfectly safe to employ:

Diameter.	Grade.	Velocity running half full.
6 inch.	1 in 60	5. ft. per second.
8 "	1 " 80	4.7 " " "
10 "	1 " 120	4. " " "
12 "	1 " 200	3.5 " " "
15 "	1 " 250	3.4 " " "
18 "	1 " 300	3.3 " " "

If less grades are necessary because of local conditions, special flushing is desirable, if not imperative. A system of flushing should be employed for all small pipes where a separate system of sewage is used, without regard to the grade or fall of the pipe. Practical experience has shown that the figures given in the preceding table can be varied slightly, but for ready reference the grades given are safe as a minimum fall for sewers of the sizes given. House connections naturally should have greater fall than those given here, that is, the pipe from the house to the sewer in the street.

An oval manhole is preferable on pipe sewers and is theoretically the best form for brick and cement sewers. Its advantage is, that it can be constructed without enlarging the foundations or altering the

form of the lower part of the sewer except for very small sewers. The manhole should be drawn to a circular form at the point of opening to permit the use of the ordinary street manhole cover.

CURRENT INFORMATION.

THE ASPHALT CONTEST IN NEW ORLEANS.

At a meeting of the streets and landings committee of New Orleans, November 29, an ordinance, originally introduced by Mr. Murray, was taken up and re-introduced by Mr. Maille, relative to paving the streets with asphalt, and directing the city engineer, when preparing specifications for asphaltic paving, to insert the words, "American lime rock asphalt, Barber asphalt, or asphalt equal or superior to either, unless property-owners petition for a particular brand." It is the desire of the American Lime Rock Asphalt Company to compete with the Barber Asphalt Company for the contracts for paving the local streets. A proposition was made to them that, as the company was unknown in New Orleans and their work of an untried character, they lay a half block of their pavement in a given street while the Barber company should lay the other half, as a test of the relative merits of the asphalt of the two companies. The American Lime Rock Asphalt Company declined the proposition, but proposed to compete in bidding for street paving, saying that if their bid was the lowest they wanted the contract. After heated arguments by representatives of both companies and the members of the committee, the ordinance was submitted to a vote and lost. The committee met again December 6, and the ordinance was again taken up, and after reading it Mr. Maille said that in order to give the city the benefit of free competition in asphalt paving an ordinance had been gotten up which would be offered as a substitute for the original one. The ordinance read:

Be it ordained by the city council of New Orleans, That whenever the city engineer is directed to pave any street in the city with asphalt, he is hereby directed to insert in the said specifications, "a concrete base of six inches in thickness, covered with a wearing surface of asphalt two and a half inches thick, after it has received its multiple compression. The asphalt cement or matrix used in the composition of the wearing surface shall contain not less than 80 per cent. of bitumen, soluble in bisulphide of carbon and none of it in water. The remaining 20 per cent. shall not contain earthy matter to exceed 1 per cent. The pavement shall require the least repairs within three years from date of completion and be guaranteed for seven years, as to maintenance by the contractor at his own expense, the whole to be secured by a good and solvent bond."

It was decided to report favorably upon the ordinance inviting free competition, without any reference to particular brand, or submitting samples to the city engineer or city chemist for tests.

The council then took the matter up at a meeting December 10, which resulted in a rejection of all that had been accomplished at the previous meeting of the streets and landings committee, and deciding that "all bids should specify asphalt alone, without regard to variety or quality, but with a guarantee, under bond, for ten years."

While competition is unanimously approved by the majority, opinion generally opposes this action of the council, mainly on its failure to set a standard for as-

phaltic paving, and passing the ordinance in its present shape, inviting all grades of asphalt, the poorest as well as the best, and leaving the citizens no alternative but to accept it.

OMAHA'S LIABILITY FOR MAINTENANCE OF A STREET.

A decision was handed down by the Nebraska Supreme Court recently in the case of James G. Megeath and others against the city of Omaha. The case dates back thirteen years, when in a deed dated Nov. 7, 1882, A. J. Hanscom, Catherine A. Hanscom, James G. Megeath and Virginia C. Megeath conveyed to the city the property which has since been known as Hanscom park. The deed contained a condition as follows:

> Also hereby convey to the said city of Omaha a strip of land eighty feet wide, adjoining and entirely surrounding said park, for the purpose of a public street or highway upon these express conditions: "That it shall forever be used and occupied as a public street or highway, and that the said city of Omaha shall lay out and improve said street or highway, and shall forever keep the same in good order and repair, at the expense of the said city of Omaha. And in case of failure or neglect to comply with any or all of said conditions, then and in that case the title to said street or highway shall revert back and reinvest in said parties of the first part, their heirs or assigns, according to their original interests."

Soon after the acceptance of the deed the street was laid out and graded, and no special tax was assessed against the abutting property on account of this improvement. All of the abutting property was then owned by the grantors in the deed, and they laid it out into lots and sold many of them for residence purposes. The city, in due time, proceeded to curb, gutter and pave the street and assess one-half of the cost against the abutting property. The property-owners asked for an injunction perpetually restraining the city from levying any taxes on account of the improvement of the street, and also praying for the cancellation of the taxes already levied, their action being based on the clause in the deed which was interpreted to mean that the entire cost of maintaining the street was to be paid by the city. The decision in the district court was adverse to the city, and an appeal was taken in 1892 by city attorney Connell. The decision of the district court is sustained by supreme court. The decision throws the heavy burden on the city, for it must not only pay for the construction and maintenance of the present pavement, but it must maintain it for all time to come. City Engineer Rosewater estimates that the decision means, practically, an expense to the city of not less than $60,000 every ten years, which sum was the original cost of the pavement. The cost of maintenance is figured at ten cents per yard, or $3,000 a year, which, computing the probable life of a pavement at ten years, would amount to $30,000 additional.

NEW ROADS IN CONNECTICUT.

Under the new good roads law in Connecticut, about thirty miles have been completed, thirteen of which have been accepted by the state road commissioners. The law provides that the state shall pay one-third of the cost of a new road, the county one-third and the town one-third, and no town to expend more than three thousand dollars in one year under the act, and the state not to spend in one year more than seventy-five thousand dollars altogether. When the law was passed it was feared that the larger and

wealthier towns of the state would avail themselves of the act, and the smaller, poorer towns would not tax themselves one-third of the cost. While this has been true to a certain extent, it has not been to the degree that was apprehended. Of one hundred and sixty-eight towns, some seventy-six will avail themselves soon of the provisions of the act.

RESTRICTION OF COMPETITION ILLEGAL.

Two decisions in paving suits were handed down by Justice Vann in Syracuse, N. Y., which are considered important, inasmuch as they establish a principle in paving which has been under discussion for some time in that city.

The paving law requires that when contracts for public work are let to the lowest bidder the element of competition in the material, as well as labor, must be respected, regardless of the law. It has been customary to circulate petitions asking that a street be paved with material made by a certain corporation.

The circumstances of the cases in which the decisions were rendered by Justice Vann are: In advertising for bids for paving Plum street the city stipulated the use of a brick manufactured by a particular paving company and no competition was allowed. The property-owners asked for an injunction to restrain the city from entering into a contract in which they were deprived of the benefit of competition in the kind of brick used. The decision of Justice Vann shows that "it was the intention of the legislature that bidders should be unhampered by any restriction whatever, except the specifications regulating the amount and quality of the labor and materials; that bidders should be allowed to buy where they can buy cheapest, so that they can bid lower than if compelled to buy of one company, and that competition should extend to one part of the contract as much as any other. * * * It is not letting to the lowest bidder if the bidder's hands are tied so that freedom in bidding is impossible; that the proceedings from the petition onward were illegal and void because they were in violation of the spirit of the law and tended to raise prices and oppress the taxpayer."

The same principle is reaffirmed in the Liberty street paving, though in it the circumstances are such that the contract is declared valid, because the bid for vitrified brick, made by a certain manufacturer, should not be considered, as that part of the proceeding was absolutely void from the beginning. The one question of competition in the use of material was the particular issue involved in the cases considered by Justice Vann, and the decision is timely and in the interest of public policy.

RECOMMENDATIONS REGARDING ROADS IN NEW YORK.

The report of Chairman Walker, of the Good Roads Committee, Batavia, N. Y., to the State Road and Prisons Commissions, states that the roads in Genesee county are in good condition and are rapidly growing better; that the taxpayers of the county are opposed to any money tax system of building roads; that they are in favor of having one commissioner in each town, to be elected by the people; that they are of the opinion that the present laws concerning road improvement are entirely sufficient; that the board of supervisors is not in favor of a compulsory wide tire law, but favors the use of such tires, and that

the board is opposed to the convict labor plan for work on roads. The report has been adopted.

INSTRUCTION BY CALIFORNIA HIGHWAY COMMISSIONERS.

An overland tour is being made through Southern California by Commissioners Manson, Irvine and Maude, members of the Bureau of Highways, Sacramento. At each meeting held the bureau gives full instructions upon the best methods of building permanent roads in different localities and with varied materials. The commissioners left San Francisco Dec. 3, and have held meetings as follows: Hollister, Dec. 5; Santa Rosa, Dec. 7; Salinas, Dec. 10; San Luis Obispo, Dec. 16; Santa Barbara, Dec. 21; Ventura, Dec. 23; from Ventura to Pasadena, thence to Riverside, thence to San Bernardino, where meetings will be held Jan. 6 and 7; San Diego, Jan. 14; Santa Ana, Jan. 18; Los Angeles, Jan. 22; Bakersfield, Jan. 28; Visalia and Hanford, Feb. 1 and 3 respectively; Fresno, Feb. 6; Madera, Feb. 8; thence through the valley counties to Sacramento, reaching that city about Feb. 11.

A DECISION AFFECTING THE BARRETT LAW.

Judge Bartholomew rendered a decision, December 21, at Indianapolis, relating to payments on street improvements under the Barrett law. Suit was brought by the Indiana Bond Company for foreclosure on property on a bond executed for street improvements under the Barrett law, in Irvington, Ind. In answer to the complaint the defendants alleged that the assessment roll was not placed in the treasurer's possession until long after the first installment had become due, and that the defendants tendered the amount of the assessment to the treasurer before it became due, but that the treasurer refused to receive it, as, not having the rolls, he did not know what the amount would be. However, as soon as the treasurer would receive the money, it was paid. The court rendered the following opinion: "The treasurer, in collecting the installments as they became due, is the agent of the city, and by the terms of the bond he is also agent of the bond company. He is obliged by law to receive these installments as they become due, and if the debtor is ready and willing to pay an installment when due, and the treasurer refuses it, he being the agent of the bond-holder, no default can be rendered. If afterward the treasurer receive the amount of the installment, the debtor is in equity released from the consequences provided in the bond and in the law for failing to pay the installment when due, equity applying the principle that no penalty can attach upon him who has done no wrong."

AN ORDINANCE TO FACILITATE STREET IMPROVEMENTS IN BALTIMORE.

An ordinance was submitted to the council, December 16, by Janon Fisher, city commissioner of Baltimore, which, if passed, will materially affect the grading, paving and curbing of new streets. The ordinance is intended to facilitate this kind of work as well as to hasten the collection of assessments on abutting property-owners who are dilatory in making payments. While the original ordinance is taken for an example in making the new one, the essential feature is amended. Original paving is now paid for by assessing property-owners, to whom the law allows

ninety days for appeal and for making payment to the city registrar. Legal entanglement is the frequent result of this method, while the contractor can not begin work until each assessment is paid, though the amount is in the nature of a lien on the benefited property. The new ordinance proposes to reduce the time from ninety to thirty days, and to give the contractor authority to proceed as soon as the time for appeal expires, regardless of the assessments, upon filing a bond guaranteeing his work for two years. The most important change proposed, however, is a clause which permits the use of different kinds of materials. Cobblestones only can be put down now on newly opened streets. It is thought that in most instances, if this ordinance is passed, the property-owners would demand other material than cobblestones, practically doing away with that class of pavements.

AN ASPHALT BLOCK PATENT SUIT.

The suit of the International Paving Co., of Hartford, Conn., against Benjamin F. Richardson, Philadelphia, to recover license fees and disputed royalties on patented machines for manufacturing asphalt blocks was tried before Judge Dallas in the United States Court at Philadelphia, on November 26th and resulted in a verdict for the plaintiff for $4,955.86, subject to questions of law reserved. The counsel for the defense related that Richardson merely secured the right to use two presses in manufacturing blocks in certain territory, and that a portion of the royalties demanded were double in amount to what he could be required to pay; also, that the plaintiff company endeavored to force the defendant to buy a certain block and tile company for $40,000, and when he declined shut off his supply of asphalt. No witnesses were introduced by the defense but nine special points, amounting to a demurrer, were submitted. Judge Dallas charged the jury to render a verdict for the plaintiff, subject to the law points reserved, and the case will not be finally disposed of for three or four months.

SERIOUS INTERFERENCES WITH PAVEMENT CONTRACTING IN ST. LOUIS.

The decision of the Missouri Supreme Court in the case of Verdin *et al. v.* The City of St. Louis has seriously disturbed pavement contracting in Missouri, and there is uncertainty as to the ultimate effects. It has been reported that plans would be devised whereby work could proceed, but nothing has yet been definitely accomplished in this direction. Hon. Robert E. McMath, president of the St. Louis Board of Public Improvements, was asked by PAVING AND MUNICIPAL ENGINEERING on December 18, "Will you kindly advise us as to what effect, in your opinion, the decision of the Missouri Supreme Court in the case of Verdin *et al. v.* The City of St. Louis will have on street paving in your city? Will you be able to make any kind of contract in the future adequately providing for the maintenance of street pavements in the construction contract?" Mr. McMath's reply is as follows:

OFFICE OF THE PRESIDENT
OF THE BOARD OF PUBLIC IMPROVEMENTS,
ST. LOUIS, Dec. 21, 1895.

To the Editor of Paving and Municipal Engineering:

The recent decisions of the Supreme Court of the State of Missouri in the case of Verdin *et al. v.* City of St. Louis, is a complete exclusion of asphalt in any form as a paving material upon any street constructed under direct city authority, until time and the votes of St. Louis citizens

permit new charter provisions to be adopted.

The decision is right, as our charter now reads, but the consequence is unfortunate for the time being.

I do not personally consider that there is any sufficient reason why the decision should hinder progress with any other paving material than asphalt, but it may be availed of to prevent the use of brick as a street paving material, upon the plea that such use is in this city an experiment, and should be guarded by a maintenance provision.

The point of the decision turns upon the provision of our charter that "the repairs of all streets and highways * * * shall be paid out of the general revenue of the city, and the paving, curbing, guttering, sidewalks, and the materials for the roadways * * * shall be charged upon the adjoining property as a special tax," etc. The courts have held in other cases that anything done to a paved street short of entire reconstruction is "repairs." We have laid wood block pavements on concrete foundations. The wood has worn out or decayed, but the concrete remains; either the city must resurface forever out of general revenue, or else tear out the concrete in order to make the property chargeable with the cost. This condition compelled abandonment of wood several years back, and renders paving with any material less lasting than granite of doubtful expediency in the eyes of many.

The decision does not stand in the way of the construction of asphalt streets by private contracts if property owners choose to take that course.

Respectfully,
ROBERT E. MCMATH,
President B. P. I.

The decision in this case was published in the December number of PAVING AND MUNICIPAL ENGINEERING, together with the explanation of the city counselor as to its unfortunate effects. In brief it holds that under the St. Louis charter a contract requiring maintenance of a street pavement by the company constructing it, where the cost thereof is assessed against the abutting property-owners for construction, is invalid, and the property-owners can not be compelled to pay the assessments. The charter provides only for charging the cost of construction to the property-owners, while the city must pay for repairs, and a contract which combines construction and repairs at the expense of the property-owner is held to be illegal.

RESULT OF THE LITIGATION OVER MEXICAN ASPHALT.

The litigation between the Mexican Asphalt Company, of Kansas City, and the Mexican Asphalt Paving Company, of Chicago, involving replevin suits, claims for damages, injunctions and criminal prosecution for perjury, growing out of the contest for possession of eighty-five tons of asphalt shipped from Mexico for the Chicago company and the ownership of which was claimed by the Kansas City company, has developed some new features since the report in the last number of PAVING AND MUNICIPAL ENGINEERING. On a warrant sworn out by Geo. W. Critchfield, president of the Chicago company, O. D. Hall, president of the Kansas City company, was arrested on the charge of perjury for making affidavit that the asphalt in controversy belonged to the Kansas City company. The trial of the case resulted in favor of Hall, without calling witnesses for the defense, the attorneys for the defendant resting on the testimony of witnesses for the prosecution. The dismissal of the case by the court was at the expense of the plaintiffs, and damage suits are even threatened by Hall.

NEW WOOD BLOCK PAVEMENT IN NEW YORK.

Twentieth street, from Broadway to Fifth avenue, in New York city, which was closed a month while it was being paved with Karrie, was opened to traffic December 21.

This block was paved as an experiment. Upon a firm, well-built macadam foundation the Karrie

wood blocks are closely laid, after being first dipped in adhesive pitch; the surface is then covered with a thin layer of small screened gravel, covered with a light coating of cement. The interstices between the blocks are made as small as possible, and the disintegration, under use, of the coating of cemented gravel fills them tightly. The American agent of the Torbay-Karri Wood-Paving Company declined to furnish a statement showing the cost per yard of laying a Karri wood pavement, or figures showing how much cheaper or more expensive than asphalt or granite blocks it is to lay or maintain it.

FINES OF CONTRACTORS IN PHILADELPHIA.

New specifications for street cleaning and the collection of garbage in Philadelphia in 1896 have been prepared by Director of Public Works Thompson. There are three classes of street-cleaning in the city, one comprising streets to be cleaned daily, others three times a week and still others twice a week. A schedule of fines to be imposed on contractors for failure to comply with the specifications is provided for in the following section:

> It is understood and agreed that the director of the department of public works has the right to deduct from the monthly payments made to the contractors the following amounts for each offense for all violations of the contracts: 1. Streets not sprinkled, or not cleaned as required, per square, $1. 2. Inlets not cleaned as required, $5 each. 3. Ashes neglected, per house, $5. 4. Ash carts not covered, or overloaded, $5 per cart. 5. Garbage neglected, per house, $5. 6. Garbage carts not covered, or overloaded, $5 per cart. 7. Crossings neglected, per intersection, $1. 8. Garbage not disposed of as required, $10 per load. 9. Sweeping dirt into inlets, $25.

It is made a condition of the contract that the question of deductions shall be decided by the director of the department of public works, and his decision upon the question shall be final and conclusive.

PUBLIC-SPIRITED WORK IN SECURING PHYSICAL IMPROVEMENT OF CITIES.

The Merchants' Association, of San Francisco, is a public-spirited organization which devotes itself largely to bringing about physical improvement of the city. Its report for the last year shows that it has accomplished much in securing the paving, cleaning, sprinkling and lighting of streets. Through an experimental contract it demonstrated that the streets of San Francisco could be cleaned better and at less expense than was being paid, and it succeeded in securing an increase of the appropriation for this purpose from eighty thousand dollars to one hundred and fifty thousand dollars. The work was afterward undertaken by the superintendent of streets, but with results which were unsatisfactory to the association, and through their influence a contract was let to the City Street Improvement Company at less than fifty cents per thousand square yards, while the average cost under the superintendent was seventy cents. The system of cleaning put into operation was in accordance with their recommendations. Much other important work of like character has been done by this excellent organization.

FORT WAYNE'S GARBAGE DISPOSAL CREMATORY.

Mr. Thomas D. De Vilbiss, chairman of the board of public works of Fort Wayne, when he read a paper on garbage disposal as conducted in his city in connection with the Dixon crematory, prom-

ised to report the results of the experiment, and has accordingly done so. The contract requires that the crematory should be capable of incinerating twenty tons of garbage of all kinds, including dead animals and night soil, in ten hours, without emission of odors. Mr. De Vilbiss reports that at a special test in ten hours' time the crematory consumed fifteen tons of garbage delivered at intervals, eight barrels of night soil and three dead horses. One and one-half tons of Indiana lump coal was used, costing $3.60, and the labor was performed by one man who is paid $2 per day. He figures that the total cost per ton of garbage was 28 cents. The city chemist certifies that there was no partially consumed garbage, and the board of health joins in testifying that there was a total absence of odor during the incinerating process.

COMING MEETINGS.

The eighth annual meeting of the Iowa Society of Civil Engineers and Surveyors will be held in the office of the State mine inspector, at the capitol, Des Moines, Iowa, commencing at 2 P. M. Wednesday, January 15, 1896.

The Illinois Clay-Workers' Association will hold its annual meeting at Streater, January 21-22. Among the subjects to be discussed will be "Paving Brick," by Thomas Townley; "Sewer Pipe," James A. Daugherty; "Comparative Value of Side-Cut, End-Cut and Repressed Brick for Street Paving," T. C. Tridell.

PERSONALS.

Mr. J. J. Weaver has been re-elected city engineer at Ludlow, Ky.

Mr. George H. Innes has been elected street commissioner at Boston, Mass.

Mr. Joseph Gustin has been appointed engineer of the water-works at Peru, Ill.

Mr. W. G. Gallager, Meriden, Conn., is a candidate for the appointment of sewer superintendent.

Mr. A. J. Cox, of the Iowa Engineering Co., of Clinton, Ia., is traveling through the South and Mexico.

Mr. E. H. Keating, city engineer of Toronto, Ont., sailed for Europe, November 27, to be absent about two months.

Mr. George J. Baer, a prominent contractor of Kansas City, Mo., has been appointed a member of the board of public works.

Mr. W. W. Lyle, of the sewer contracting firm of Lyle & Morton, Erie, Pa., died suddenly in Meadville, Pa., November 22.

Mr. Augusta J. Phillips has been appointed water commissioner at Kingston, N. Y., to fill the vacancy caused by the resignation of Mr. John W. Searing.

Mr. A. D. Thompson, city engineer of Peoria, Ill., has been engaged by the city of Gilman, Ill., to design and superintend the construction of a system of water-works.

Dr. F. P. Van Denbergh, of the Van Denbergh Laboratory, Buffalo, N. Y., has been retained as consulting chemist by the Baldwin Fertilizer Works, and is now making an examination of their works at Port Royal, S. C.

Col. George E. Waring, commissioner of street cleaning, and Alexander Potter, Assoc. M. Am. Soc. C. E., delivered addresses on "Country House Sewerage," at a dinner given at the Metropolitan Club, by the New York Farmers, December 17.

The Engineering Association of the South has elected officers for the next year as follows: President, Mr. Hunter McDonald; first vice-president, Mr. W. G. Kirkpatrick; second vice-president, Mr. J. J. Ormsbee; secretary, Lucius P. Brown; treasurer, Mr. W. M. Leftwich; directors for Tennessee, Maj. E. C. Lewis, Dr. W. L. Dudley, Mr. Herman D. Ruhm; director for Kentucky, Mr. John B. Atkinson.

LEGAL DECISIONS.

[Reported specially for PAVING AND MUNICIPAL ENGINEERING.]

Liability for Obstruction of Street.—A city is chargeable with notice of an obstruction standing for three or four days in one of its much-used streets. Briel *v.* City of Buffalo (Supreme Court of New York), 35 N. Y. S. 359.

Notice of Defective Streets.—It is not necessary, says the Court of Appeals of Kansas, in order to charge a city with negligence or carelessness for defective street crossings, that notice of the defect should be brought to it by actual complaint. If the city carelessly and negligently permits defects to exist in its street crossings, no matter how caused, for so long a time that notice is presumable, then it becomes liable if a person injured thereby, without fault or negligence on the part of such person. Junction City *v.* Blades, 41 Pacific Rep. 677.

What City May Recover for Laying Walks Over Line.—Where a municipality, on failure of a property-owner, after due notice to construct a sidewalk, constructs the same, and in so doing places a portion of its length on the property of the owner, it is entitled to recover for so much of the walk as involved no trespass on the owner's land. Athens *v.* Carmer (Supreme Court of Pennsylvania), 32 Atlantic Rep. 422.

When Notice of Defective Streets is Unnecessary.—The provision of a city charter that the city shall not be liable for any injury caused by the defective condition of its sidewalks unless actual notice of such condition has, prior to the injury, been given to the mayor or council, does not apply where an obstruction of the sidewalk is created by the officers of the city. Stedman *v.* City of Rome (Supreme Court Fourth Department), 34 N. Y. S. Rep. 737.

Control of Streets in Pennsylvania.—Under the laws of Pennsylvania, a city has the supreme control over the streets, pavements, etc., and determines, in the exercise of its functions, everything in connection with their grading, paving and condition according to its best judgment; and where it chooses to grade its streets so as to leave only a two-inch depth of gutter, instead of six, it may do so without being subject to any control of the courts. Though a city may, for any arbitrary or unreasonable arrangement of its grades, which works injury to the property of an abutting owner, be responsible in damages for the injury, the courts can not take away from the city by mandatory injunction its right exclusively to establish street grades. McHale *v.* Easton and B. Transit Co. (Su-

preme Court of Pennsylvania), 32 Atlantic Rep. 461.

Assignment of City Contract.—In an action against the assignee of a paving contract for material furnished, it appeared that the assignment was absolute on its face; that after the assignment the assignees kept no account with the assignor; that they furnished all other materials not furnished by the party suing, paid the bills and received pay for the work, and stated in a verified complaint to collect an assessment for the work that they became and were, by the assignment, contractors to perform the work. The Supreme Court of California held that the party suing could recover against them. McCarty *v.* Owens, 41 Pacific Rep. 861.

Indebtedness in Excess of Revenue Void.—When a statute provides that a city shall not incur liability in any year in excess of the revenue of that year without the consent of two-thirds of the qualified voters, a levy and assessment for liabilities so incurred is void. And where a levy and assessment for payment of a claim against a city is invalid, one for payment of a judgment on such claim will also be invalid. Smith *v.* Broderick (Supreme Court of California), 40 Pacific Rep. 1033.

Negligent Grading and Curbing of Streets.—A city, says the Superior Court of Delaware, is liable for damages to an abutting property-owner for the flooding of his cellar and undermining of the walls of his building, caused by its negligence in grading and curbing the street and sidewalk, but not if the work was properly done, and the injury was one necessarily incident to the property, owing to its location and the wet and marshy condition of the land. Benson *v.* Wilmington, 32 Atlantic Rep. 1047.

MACHINERY AND TRADE.

The Wrought Iron Bridge Co., Canton, O., is very busy.

The purchase of a street road roller is contemplated at La Cross, Wis. Wm. Grover, chairman.

The purchase of a stone-crusher is contemplated at Parkersburg, W. Va., by the board of trade. R. E. Homer is president.

Samples of marl found near Winona, Minn., are said to possess nearly the proper composition for a good Portland cement.

The Weir Plow Shops, Monmouth, Ill., were almost destroyed by fire December 12. The loss will probably reach $150,000.

The O. S. Kelly Co., Springfield, O., has been awarded bronze medals for its exhibit of steam road rollers at the Atlanta Exposition.

A large and handsome calendar for 1896 has been sent out by the Clinton Paving and Building Brick Company, of Clinton, Ind.

J. E. Dawson, C. E., Owensboro, Ky., says that Davies county has recently purchased six Champion road-graders for county roads.

The Congo Fire Clay Co., Empire, O., whose works burned recently, contemplates rebuilding with all modern improvements.

A steel bridge syndicate is, according to report, trying to secure a location for a plant at Alexandria, Ind., which would employ 3,000 men.

Taplin, Rice & Co., of Akron, O., have had a gratifying increase of business during the last year, and they think the prospects indicate a good trade in 1896.

Aultman & Lovejoy, of Chicago, are said to be interested in establishing a plant for the manufacture of street cars at Steubenville, Ohio.

E. M. Freese & Co., of Galion, O., report a good demand for their machinery. One of their new features is a cut-off giving a curvilinear motion to the wires, which turns out a brick with perfect surface.

The Enterprise Mfg. Co., Columbiana, O., made a recent sale of a steam road roller to the town of Danielson, Conn. Orders have also been taken, for spring delivery, for five more road rollers in New England towns.

Proposals are asked by Riverside, Cal., till January 7, 1896, for furnishing a street sweeper of modern construction. Bidders will furnish their specifications and circular descriptive of the machine offered. W. W. Phelps is the city clerk.

The Chambers Bros. Co., of Philadelphia, during 1895 gained 40 per cent. in business over 1894. They regard the outlook for the next year as encouraging. Among the most notable of their new machines is their double die power repress.

The Mack Mfg. Co., of New Cumberland, W. Va., is converting its Eagle Brick Works into a sewer pipe manufacturing establishment. The Mack Mfg. Co. has recently shipped large orders for paving brick to New Orleans and Louisville.

A movement is on foot to purchase all the granite quarries at Barre, Vt., by a stock company. E. L. Smith, C. N. Field, W. A. Boyce, S. C. White, of Barre; Jas. Gasely, of Albany, N. Y., and A. L. Sortwell, of Montpelier, Vt., are interested.

An attractive display was made at the Atlanta meeting of the National Brick Manufacturers' Association by the Frey-Sheckler Co., of Bucyrus, O., who were represented by W. W. Reehl.

The McLagon Foundry Co., of New Haven, Conn., has found it necessary to enlarge its facilities for manufacturing brick machinery. The company will be known as the Eastern Machinery Company, but the ownership and management remains the same as heretofore.

The sewer pipe manufacturers in Ohio, including companies at New Cumberland, Toronto, Freeport, Uhrichsville, Lisbon, Dennison, Canal Dover and other places will combine and bid for furnishing sewer pipe for the complete underground sewerage system at New Orleans.

The Transcript, Peoria, Ill., says that the fine quality of shale discovered about Peoria is, without doubt, up to the standard for manufacturing paving brick, and hopes that it will be developed in time to enter competition for the large amount of brick paving contemplated in that city next year.

The Grand Ledge Sewer Pipe Company, which is credited with having the best equipped plant of the kind in Michigan, has ten large kilns and two others are now in course of construction. The company also intends to put in a larger engine and contemplates making other additions. Their works cover nine acres. The officers of the company are A. B. Schumaker, president; J. W. Fitzgerald, vice-president; Geo. N. Berry, treasurer; F. A. Taber, secretary and J. D. Summers, general manager.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Denver, Col.—The board of public works rejected all the bids for paving lower Fifteenth-st. Dec. 13, and the contract will be readvertised.

Lansing, Mich. — (Special.) — Jasper C. Davis, city engineer, says that no definite information can be given in regard to paving for next year.

Norwood, O.—The citizens assembled in a mass meeting Dec. 7 and adopted resolutions favoring the improvement of the Montgomery pike at once.

Pensacola, Fla.—(Special.)—F. Glackmeyer, city clerk, says that the city does not contemplate any work on the streets, sewers or bridges this year.

Portsmouth, Va. — (Special.) — E. C. Thompson, jr., says that no contracts will be let before spring, if at all, for paving. Paving is done by day's work.

Oskaloosa, Ia.—Paving brick is being used for the foundation of the new methodist church, and it is claimed that it possesses advantages over stone for this purpose.

Glen Ridge, N. J.—The annual report of the road committee shows that six and one-half miles of road have been repaired during the last year, at a total cost of $2,535.34.

Jamestown, N. Y.—During the last season 24,000 square yards of fine brick pavement have been laid with the most satisfactory results. The Jamestown block was used.

New Castle, Pa.—The streets paved this year according to specifications and accepted by the city are: N. Mill-st., $1,896.18; Moravia-st., $21,943.02; Pittsburg-st., $7,071.24.

Paterson, N. J.—Mayor Braun favors an asphaltic pavement around the new city hall, but is opposed to it just at present on account of the Market-st. grade, which will have to be lowered.

Kansas City, Mo.—A communication that appeared in the Star Dec. 1 asks why the Fruin-Bambrick construction company of St. Louis cannot be invited to this city to compete for asphalt paving contracts.

Baltimore, Md.—(Special.)—Janoo Fisher, city commissioner, says that there is about $100,000 available for repairing streets with improved pavement, but the city council has not as yet designated how it shall be spent.

New sidewalks are paved with granolithic mixture, asphalt tile, or ordinary paving brick; alleys are paved with asphalt block, vitrified paving brick and block. The average cost of these improvements is: Granolithic walk, $1.44 per square yard; asphalt tile walk, $1.50 per square yard; paving brick walks, 70 cents per square yard; asphalt block pavement, $2.10; vitrified brick and block pavement, $1.96 per square yard.

Quincy, Ill.—The total amount of paving done this season amounts to twenty-three blocks, of which six and one-half blocks were paved by the city and sixteen and one-half blocks by the Talbott paving company of Detroit, Mich.

Brooklyn, N. Y.—The Good Roads association of this city has decided that the most available street to improve as a means of connecting the Eastern boulevard with the macadamized roads of Queens county is Glenmore-ave. The question to be decided now is the character of the pavement, the choice laying between macadam, asphalt and vitrified brick.

Knoxville, Tenn.—The pike commissioners are enthusiastic over the new pike which is to built from Shook's Gap to Sevierville, a distance of 17 1-3 miles. It will require $35,000 or $40,000, and it may be some time before the pike is constructed, as bonds will have to be issued in order to raise the money. D. R. Pitner, G. W. Caton and Dr. G. E. Shark are the pike commissioners of Sevier county.

Stockton, Cal.—A building has been erected in P. A. Buell & Co.'s lumber yard in which wood blocks for paving are boiled in asphaltum. Odds and ends of lumber four inches thick are sawed up and thrown into the boiling mixture. It is Mr. Buell's intention to pave some of the driveways between the lumber piles with these blocks to see how they will compare with other wooden pavements that are laid in the yard.

Kansas City, Mo.—City Counselor McDougal filed with Mayor Davis about Dec. 1 a communication against plank sidewalks, in which he says that of 280 miles of plank sidewalks that the property-owners have paid in special tax bills during the last fiscal year $7,641.37, while repairs made by the property-owners direct, and of which no record can be kept, approximate $10,000, and supervising the work $5,000, making a total of $22,641.37 in one year. He advises that brick or material better than brick be used.

Richmond, Va.—The committee on streets recently granted permission to Mr. Warner Moore to put down a patented pavement at the intersection of Cary and Thirteenth-sts. to test its durability. The material is blocks of marsh grass, soaked in a preparation of oil and tar, which was described in a recent issue of Paving and Municipal Engineering. The blocks are 2x1 feet and six inches thick; they are tied with wire and laid in sand; the seams are filled in with the tar and oil preparation, and the entire pavement laid in fine gravel. Frost will not affect the pavement, it is claimed, and it will prevent horses from slipping. The pavement was invented about four years ago and is said to be successfully used in Elizabeth, N. J., and in Philadelphia. It will cost about $2 per square yard.

Cranston, R. I.—Town Engineer Latham, who is clerk of the Babbitt commission, will advertise soon for public hearings on the widening and straightening of Cranston-st., on which the lines of the assessment area will soon be announced. The improvement was first assessed by the Sanders commission, but was so unjust and excessive that, coupled with other opposition, the town council deemed it sufficient cause to reject it without advertising public hearings. The Babbitt commission's plans differ considerably from those of the Sanders commission.

Jacksonville, Fla.—The progress made during the last six months in the construction of pavements and sidewalks surpasses the record of any previous six months in the history of this city. Besides completed work, the board of public works has under process of completion and authorized by the city council 65,732 square yards of vitrified brick pavement at an estimated cost to the property-owners of $64,282 and to the city of $30,398. It has in contemplation and is waiting for the authorities to let the contracts for 55,127 yards of brick pavement in addition, at an estimated cost to the property-owners of $64,081 and to the city of $30,446.

Charleston, S. C.—A statement of the work done by the street department was presented to the council Dec. 3 by Alderman G. W. Williams, jr., which shows the following: Blue stone flag pavements laid, 16,937.82 square feet; blue stone curbing, 5,253.6 lineal feet; granite block roadways, 5,465.15 square yards; cobblestone roadways, 3,104.76 square yards; concrete sidewalk, 2,914.03 square yards; pipe drains, 1,310 feet 8 inches; 950 feet 10 inches; 1,425 feet 12 inches; 560 feet 15 inches, and 40 feet 18 inches. The hope is expressed that an asphalt roadway in King-st., from the Battery to Ladsom-st., is only the beginning of a roadway of asphalt which will be eventually continued the entire length of King-st.

Washington, D. C.—(Special.)—The operations of the Surface department for the fiscal year ending June 30, 1895, show that 38,694.73 square yards of sheet asphalt on concrete base have been laid; 4,076.51 square yards of sheet asphalt on macadam base, asphalt block 5,729.25 square yards, granite block 561.00 square yards, brick sidewalks 1,454.32 square yards, curb laid and relaid 24,805.01 lin. feet, cobble gutters, etc., 8,400.32 square yards, vitrified block 4,609.24 square yards, cobble removed 17,054.79 square yards. This work was all done by contract at the following prices: Sheet asphalt on 6-inch concrete base exclusive of grading, $1.68 per square yard; sheet asphalt, 4-inch base, $1.50 per square yard; sheet asphalt, cobble base, 45 cents per square yard; asphalt block, concrete base, $2.25 per square yard; asphalt block, gravel base, $1.78 per square yard; granite block, on gravel, 98 cents per square yard; relaying brick, 25 cents per square yard; vitrified block gutters on 6-inch concrete base exclusive of cost of brick, $1.00 per square yard; vitrified block delivered at property yard $22.50 per thousand.

Newark, N. J.—An experiment was made recently with asphalt on cobblestone base instead of concrete. The cobbles were laid as in ordinary cobble paving and the interstices swept clear of the sand; on the surface was laid a coating of crushed stone mixed with asphalt cement to a thickness of three-quarters of an inch, which in many places was two inches thick, because of the interstices; on top of this was laid the asphalt surface, two inches in thickness. The cost of the paving on this base is $2.25 per square yard, and is guaranteed for five years. The average cost of asphalt on concrete is $2.70 per square yard. The pavement was laid under the supervision of William Henry, superintendent of the Barber asphalt company, H. M. Marsh and Assistant General Manager Furnam. Mr. Henry says that in New York probably a million square yards of asphalt pavement has been laid over trap-rock block paving, and in Brooklyn it is no longer considered an experiment; in Jersey City three streets have been paved with asphalt over a cobblestone base.

St. Louis, Mo.—The board of public improvements will institute a marked change of policy in street reconstruction in the western portion of the city, and in all outlying districts, and particularly relating to cross streets, or streets running north and south. Lots on these cross streets are 150 feet deep and run to the alley, so that there are but four lots to a block to bear the assessment for street improvement, and consequently a sufficient sum cannot be raised to improve both the street and sidewalks. To improve the street incurs a cost of $4.50 per running foot, and to make a six-foot sidewalk costs $1 per foot, or $5.50 per foot for street and sidewalk. Heretofore the streets have been improved with macadam and the sidewalks were not constructed. The lack of sidewalks has been a great inconvenience to the citizens of these streets, and, besides, has materially affected rents and values of property. Those who favor the change of policy reason, that as these cross streets are used but comparatively little for driving, it would subserve the interests of that section much more to have sidewalks instead of macadamized streets, so that it is proposed hereafter to have sidewalks constructed first instead of the macadam roadway.

CONTEMPLATED WORK.

Woburn, Mass.—Main-st. and others will probably be rebuilt in the spring.

Midland Park, N. J.—The macadamizing of the main thoroughfare is being considered.

New Orleans, La.—The business men on Canal-st., from Magazine to Claiborne, think it should be paved with asphalt.

San Francisco, Cal.—The South Side taxpayers are anxious that the work of paving Folsom-st. with bitumen be proceeded with.

Minneapolis, Minn.—(Special.)—F. W. Cappelen, city engineer, says that he has simply recommended that certain streets be repaved, the amount aggregating about 133,000 square yards. The city council will, after Jan. 1, 1896, order the new work.

Jacksonville, Fla.—The petition for paving with vitrified brick Kelerec-st., from Dauphin to Claiborne, was referred to the city engineer.

Brooklyn, N. Y.—Alderman Leich has offered a resolution to pave with asphalt the north side of Atlantic-ave., between Albany and Troy-aves.

Wilkinsburg, Pa.—The proposition to issue $265,000 worth of paving bonds carried Dec. 17, and all of the streets of the borough will be paved.

Sioux City, Ia.—A resolution was adopted Dec. 17 authorizing the city engineer to prepare plans and specifications for various kinds of pavements.

Schenectady, N. Y.—Residents of Albany-st. have presented a petition to the council asking that their street be paved with asphalt in the spring.

Easton, Pa.—An ordinance is being considered by councils, to be submitted to the citizens for vote, authorizing the issue of $100,000 in bonds for street and other improvements.

San Francisco, Cal.—A petition has been circulated among the property-owners on Market-st., from Ferris to Haight-st., for a bituminous pavement on a ten-inch concrete base.

Peoria, Ill.—(Special.)—A. D. Thompson, city engineer, says that the city has in contemplation for next season the construction of about twelve miles of asphalt and brick pavement.

Jacksonville, Fla.—Ordinances were passed Dec. 17 for paving with brick Florida-ave., from Bay to Beaver; Adams, from Main to Stuart, and Forsythe, from Market to Drew-sts.

Pittsburg, Pa.—An ordinance was introduced in councils Dec. 16 for opening Ann-st., from Pride to Stevenson. This ordinance will be followed by another for paving Ann-st., from Boyd to Soho, with asphalt.

Denver, Col.—A final resolution was passed Dec. 18 by the board of public works recommending that the city council pass an ordinance authorizing the grading and paving with asphalt of Colfax-ave., from Broadway to York, a distance of nearly two miles.

Erie, Pa. (Special)—George Platt, city engineer, says that the councils have passed a resolution instructing the city engineer to submit an ordinance for a vitrified brick pavement on a six-inch concrete base on Sixth-st., from Parade to East-ave., a distance of 4,026 lineal feet. Width of roadway, thirty-six feet.

Bridgeton, Pa.—The question of street paving is being warmly agitated. Messrs. Oberlin Smith, Edward M. Pithian and William MacFarland, the committee on municipal improvements, have recommended vitrified brick as the pavement best adapted to this city, and the recommendation has been indorsed by the board of trade.

St. Louis, Mo.—It is reported as probable that the street improvement bids which have been pending since last May will be passed in time for the streets to present a creditable appearance by June, 1896. The contemplated improvements embrace the paving of four and a half miles of street and one and a half miles of alley. The bills provide for vitrified brick.

Gloucester, Mass.—The committee on highways offered a plan Dec. 6 for relaying and widening two miles of Washington-st., one of the principal thoroughfares of that city. The estimated cost is $50,000. The matter was referred to the incoming city government.

Brooklyn, N. Y.—The common council contemplates grading, curbing, guttering and paving with Belgian block three feet on each side of Vernon-ave., from Flatbush-ave. to Canarsie-st.; grade, curb, gutter and pave with Belgian block three feet on each side of Regent-place, from Flatbush-ave. to Ocean-ave.

Saginaw, Mich. (Special)—R. F. Johnson, city clerk, says that "Last July resolutions were passed ordering the paving of nine streets, aggregating something over three miles in length. These resolutions were passed at that time in order that the underground sewer, water and gas connections could be ordered, and they were ordered and put in during the fall. The resolutions last summer did not specify the surface material. The matter is now before the council for the passage of resolutions specifying the surface material, and it will be some time, following our usual course of practice, before we advertise for contracts. It is estimated that we will lay about $125,000 worth of pavements next year. There probably will be one small job of asphalt and perhaps one of macadam, the balance being divided between brick and sapless cedar blocks."

CONTRACTS TO BE LET.

Lafayette, Ind.—Sealed proposals will be received until Jan. 13 for improving Thirteenth-st., from Tippecanoe to Hartford. T. W. Burt, city clerk.

Rome, Ga.—Bids will be received until Jan. 4, 1896, for 325 lineal feet of 4-inch gravel on the road leading from Beall's ferry. Address Thos. R Evans or J. E. Camp.

East St. Louis, Ill.—Sealed proposals will be received until Jan. 15, 1896, by H. F. Bader, mayor, for paving Illinois-st. with brick or block, on elco, macadam or brick foundation. Check, $1,000.

Toledo, O.—Sealed proposals will be received until Jan. 20, 1896, for paving Nineteenth-st., from Monroe to Washington, with Trinidad pitch lake asphalt. Cash deposit, $100. Lem P. Harris, city clerk.

Niagara Falls, N. Y.—The city engineer has been instructed to advertise for bids for paving with asphalt Ontario-ave., from Main to Lockport, and Main, from Niagara to Fourth. S. F. Arkush, city clerk.

Camden, N. J.—Sealed proposals addressed to the committee on streets and highways will be received until Jan. 3, 1896, for paving Elm-st., from Second to Third, with assorted rubble; and Main-st., from Third to Fourth, with Belgian blocks. Certified check, $200. Chas. P. Sayres, chairman.

Bloomington, Ill.—(Special.)—Bids will be asked about the middle of January, 1896, for 3½ or 4 miles of brick pavement, 30 or 36 feet wide, stone curbing, two courses of brick, and paid for in vouchers at 6 per cent. interest. First one cash, balance in 1, 2, 3 and 4 years. W. P. Butler, city engineer.

Wyoming, O.—Sealed proposals will be received until Jan. 3, 1896, for macadamizing the roadbed and setting the curb and gutter of Oliver-st. Certified check, $200. W. A. Clark, clerk.

Cincinnati, O.—Sealed proposals will be received until Jan. 4, 1896, for paving Golden-ave. with brick; paving Whetstone alley with granite and setting granite curbs. A. P. Butterfield, clerk B. of A.

Evanston, Ill.—Sealed proposals will be received until Jan. 7, 1896, for grading, paving and otherwise improving Sherman-ave., from Emerson to Noyes-st. Certified check, $1,000. Mark Wymond, commissioner public works.

Terre Haute, Ind.—Sealed proposals will be received until Jan. 7, 1896, for paving the sidewalks of Seventeenth-st. with gravel screenings and curbing with hard limestone, and paving the roadway with broken stone. Bond, $200. Chas. H. Goodwin, clerk.

Boston, Mass.—The Metropolitan park commission of Massachusetts will receive sealed proposals until Jan. 3, 1896, for building a driveway to subgrade in the Mystic Valley parkway in Medford and Westchester. Certified check, $1,000. William T. Pierce.

Albany, N. Y.—Sealed proposals will be received until Jan. 6, 1896, for curbing, forming and completing the sidewalks and paving the roadway of Fourth-ave. with dimension granite blocks; paving Swan-st. with vitrified brick, from Chestnut to Elm-st. Thos. J. Lanahan, clerk.

CONTRACTS AWARDED.

Jersey City, N. J.—The contract for improving Jackson-place was awarded to Thomas F. McCabe of this city for $2,000.

Toledo, O.—The contract for paving South-st., from Broadway to Hiett-ave., was awarded to William McMahon, whose bid amounted to $19,337.

Bangor, Me.—The contract for furnishing 5,000 yards of granite paving blocks to this city has been awarded to James S. Condon of South Brooksville at 87 cents.

Orange, Conn.—The contract for constructing a macadam pavement was awarded to C. W. Blakeslee & Sons of New Haven, Conn., at $2.18 per lineal foot—thirty-six feet.

Waterford, Conn.—The contract for building the trap rock road was awarded Dec. 19 to H. L. M. Ladd at $23.47 per lineal rod, and 50 cents per square yard for cobble gutters.

Topeka, Kas.—The contract was awarded Nov. 26 for paving the alley back of the new court house with vitrified brick to H. K. Winams of North Topeka at $1.22 per square yard.

Lexington, Ky.—W. H. Loughbridge of the Lexington contract company, this city, was awarded the contracts for paving N. Limestone and Vine-sts. with brick. His bid was on the Mack brick or block.

Saginaw, Mich.—The bids for paving James-st., which were received last summer, were taken up Dec. 13 and the board of public works was authorized to contract with Scanlon & Crowley, whose bid was $4,306. Saginaw brick will be used.

St. Louis, Mo.—(Special)—H. R. Graham, manager S. P. McKelvey & Co., says that the company has just closed a contract for 28,000 lineal feet combination granitoid curb and gutter and sidewalk, five and six feet wide, with the Fair Grounds real estate company, for the improvement of Chouteau-place. The work will be done under the supervision of Pitzeman company of surveyors and engineers. This is the largest granitoid curb and gutter and sidewalk contract ever let west of the Mississippi river.

SEWERS.

Cleveland, O.—The election in Glenville Dec. 10, to bond the village for $200,000 for sewerage, resulted unfavorably.

Glenwood, Ia.— (Special.)—H. Evernham says that the sewer is about completed.

Dwight, Ill.—The city council has decided to pump the town sewage by means of a wind pump upon a tract of two acres.

Owensboro, Ky—(Special.)—J. E. Dawson, city engineer, says that nothing definite has been decided upon the city's proposed sewerage system.

Saugerties, N. Y.—(Special.)—J. Dedereck says that no definite plans regarding sewerage have been decided upon as yet. The matter is merely under consideration.

San Francisco, Cal.—The large sewer, which is 18,550 feet long, and constructed of 8-inch iron stone pipe, connecting the county infirmary buildings with tidewater at the bay shore, is nearly completed.

Des Moines, Ia.—During the year 3,744½ feet of 12-inch sewers have been built at a cost of $2,992.69, or on an average price per foot of 77 cents. There is partially completed about two miles more of sewers, ranging from 12 to 48 inches.

Altoona, Pa—(Special.)—Judge Barker granted a preliminary decree restraining the pollution of the Juniata. A hearing was set for Dec. 27 at Hollidaysburg. The details of this injunction suit were given in the December number of Paving and Municipal Engineering.

Mobile, Ala.—The select committee of the general council refuses to consider any proposition for a sewerage system which entails the granting of a franchise of any character. Waring, Chapman & Farquhar of New York, and the Brownell improvement company of Chicago have each offered to take collateral and build the system, pushing it to completion at once. Final action has not been taken as yet.

Washington, D. C.—Recent investigations in the sewer department disclosed the fact that a large number of sewers built twenty years ago are so faulty in construction that they will have to be replaced with new ones. The greatest trouble seems to have been that the roots of trees had found their way through small openings in the imperfectly joined pipes and had completely stopped up the sewer. Another fault found with the construction in those days was the method used. When the way was barred by an obstruction of any kind, instead of removing it and carrying the sewer on in a straight course, it would be built around the obstruction.

Quincy, Ill.—About eight and a half blocks of sewers have been constructed this season.

Bridgeport, Conn.—Chairman Hurd says that the board of appointment and taxation will not appropriate $200,000 for a complete overhauling of the sewer system, but will make slight repairs only.

Philadelphia, Pa.—The Allegheny-ave. sewer near Edgemont-st. shows a fine piece of city engineering. A single cylinder empties into a twin sewer and the flow of water is regulated by a weir, owing to the fact that just at this point the top of the sewer approaches so near the surface of the street that the additional strength of the twin arch is necessary to prevent breakage. It is also a tidal sewer and is meant to empty its contents at low tide into the Delaware. The diameter of the main sewer is nine feet three inches and that of the twin sewer is seven feet nine inches each. The construction of the twin sewers by increasing the strength of the support below saves raising the grade of the street over the sewer, thereby saving to the city the damages which would have been incurred otherwise.

New York City.—The commission which is to report in January to the legislature as to the advisability of a trunk sewer in the Bronx valley met at Mayor Strong's private office Dec. 2 and adopted a resolution favoring the construction of a trunk sewer twenty miles long and ten feet wide at an estimated cost of about $2,000,000. The sewage of all the small towns and villages that now pollutes the Bronx river will be carried off. A committee was appointed to consider this part of the subject and report, consisting of the following: Mayor Strong, city; Mayor Peene, Yonkers; Mayor Lewis, Mt. Vernon; James Wood, Mt. Kisco; Frank Carpenter, chairman board of supervisors of Westchester county. A series of public hearings will be given during the first ten days of January in White Plains, Mt. Vernon, Yonkers, Williams bridge and in this city. The commission will report back to the legislature previous to March 4, 1896.

CONTEMPLATED WORK.

Billings, Mont.—A complete sewerage system is being agitated.

Coffeyville, Kas.—A sewerage system is contemplated for next year.

Niagara Falls, Ont.—The tax-payers will vote upon the proposition to raise $109,000 for sewers Jan. 6.

Red Bank, N. J.—The commissioners have decided to provide a sewerage system for this town. Estimated cast, $50,000.

Decatur, Ill.—An ordinance will be drafted for extending the Broadway sewer 5,000 feet.

Stratford, Ont.—Alan MacDougall, C. E., has under consideration plans for the extension of the sewerage system in this city.

Milwaukee, Wis.—It is probable that work on the Kinnikinnic river flushing works will be commenced early in the spring.

New Orleans, La.—Final action will not be taken on the specifications for the drainage scheme for about sixty days or thereafter.

Swarthmore, Pa.—The council has adopted the intermittent sand filtration method at a cost of about $2,000. E. B. Kay, engineer.

Rock Falls, Ill.—F. D. Rosebrook, William H. Kadel and C. W. Dow have been appointed commissioners to estimate the cost of the new sewer system.

Perth Amboy, N. J.—The council has passed ordinances for the construction of a 36x24 inch brick sewer in two streets. William King, jr., city clerk.

Welland, Ont., Can.—The mayor and city engineer have interviewed Dr. Bryer, secretary of the Provincial board of health, with regard to the extension of the sewerage system.

Galveston, Tex.—Dr. C. W. Truehart urges upon the citizens the importance of concerted action in securing a sewerage system adequate to the demands of a growing city.

New York City—Plans are being prepared for the disposal of the sewerage of the new building to be erected for Columbia college, One Hundred and Sixteenth-st and Morningside drive, by John R. Binley, C. E.

Rochester, N. Y.—A map is being prepared by City Engineer McClintock for a proposed tunnel sewer 100 feet below the surface of the ground, to dispose of the overflow from the Central-ave. sewer. It will be 300 feet long.

Belmont, Mass.—(Special.)—W. L. Chenery, town clerk, says that E. A. W. Hammett, C. E., is preparing a survey for a system of sewers to connect with the main sewer which has been constructed this year. The sewers will be built as needed.

Wilson, N. C.—(Special.)—John R. Moore, city clerk, says that this town has voted favorably on the issue of $17,000 for the sewerage. The bonds, which will be for $500 each, will be for sale about Jan. 1, 1896. They will run twenty years at 6 per cent., payable annually.

St. Cloud, Minn.—(Special.)—C. L. Atwood, chairman sewer committee, says that sewerage systems are being investigated with a view to quite a large amount of work—just how much has not been decided upon as yet, but will be soon. The sewerage of the city has been neglected.

Peoria, Ill.—(Special.)—A. D. Thompson, city engineer, says that a small sewerage system of about three miles and the completion of the West Bluff sewer system is contemplated by the city for next season. It will cost about $375,000 to finish the West Bluff sewer.

Rochester, Minn.—(Special.)—W. C. Fraser, C. E., says that this city contemplates putting in several thousand feet of sewers next summer. During last summer a main sewer 6,500 feet long was constructed. The contract has also been let for a sewer on Zumbro-st., which will be 4,232 feet long.

Santa Rosa, Cal.—The city council is experiencing difficulty in devising some method of disposing of this city's sewerage. The advisability of issuing bonds for the construction of a sewer outlet to tide water, which would cost about $75,000, is being discussed by some of the leading citizens, according to report.

Bellefontaine, O.—Considerable trouble is being experienced over the question of sewerage because the board of health has prohibited sewerage being run into Possum run, the city's only means for drainage for the principal part of it. The citizens demand a new sewerage system and it is probable that their demands will be complied with.

Rochester, N. Y—The East Side trunk sewer commission decided Dec. 16 to construct a storm overflow sewer to empty into the river near Gregory-st., for the purpose of taking care of the storm water of the territory above and relieving the existing sewer in lower Mt. Hope-ave. Designing Engineer Kinchling and Supervising Engineer Peacock both agree as to the advisability of choosing this route.

CONTRACTS TO BE LET.

Santa Monica, Cal.—Sealed bids will be received until Jan. 6, 1896, for building a sewer, with necessary appurtenances, C. S. Dales, town clerk.

East St. Louis, Ill.—Sealed proposals will be received by H. F. Bader, mayor, until Jan. 15, 1896, for constructing a sewer in Illinois-st., from Collinsville-ave. to Tenth-st. Certified check, $1,000.

Ft. Madison, Ia.—The city council has authorized the sewer committee to advertise for bids for the construction of a pipe sewer in Spruce-st., to extend to the river. The plans and specifications will be drawn by City Engineer Robertson.

St. Louis, Mo.—Bids will be received until Jan. 7, 1896, for the construction of sewers as follows: Cherokee district No. 8, 620 feet 15-inch and 600 feet 12-inch pipe; Gascanade-st. No. 2, 240 feet 18-inch and 520 feet 15-inch and 40 feet 12-inch pipe; Ferry-st. No. 25, 440 feet 15-inch and 330 feet 12-inch pipe. President McMath of B. P. I.

Washington, D. C.—Sealed proposals will be received until Jan. 25, 1896, for constructing a main intercepting sewer from near the intersection of P-st. and Florida-ave. to near the intersection of Twenty-fifth and M-sts., northwest, with lateral branches on M and Twenty-seventh-sts. G. W. Ross, George Truesdell, Charles F. Powell, commissioners D. C.

Grand Junction, Col.—Sealed proposals will be received until Jan. 7, 1896, for excavation and back filling of about eleven miles of ditches in the city and about twenty-four miles outside the city. Bids are also wanted for about 800,000 hard-burned brick; hauling 1,200,000 feet of dressed lumber and for about 1,600,000 pounds of cast iron pipe and specials. W. F. McCue, 703 Boston building, Denver, Col.

Brooklyn, N. Y.—Sealed proposals will be received until Jan. 7, 1896, for constructing sewers in Fifty-second-st., from Fifth to Sixth-ave., and in Sixth-ave., from Fifty-first to Fifty-second-st.; deposit, $75. Also, a sewer in Fifty-sixth-st., from Fifth to Sixth-ave., and Sixth-ave., from Fifty-fifth to Fifty-sixth-st.; deposit, $75. Certified check in the same amount of the deposit. A. T. White, commissioner.

CONTRACTS AWARDED.

Cranford, N. J.—The contract for constructing lateral sewers was awarded Dec. 9 to Feli & Costa of Orange for $14,550.75.

Denver, Col.—The contract for constructing the South Side sanitary sewer, No. 2, was awarded Dec. 18 to J. M. O'Rourke for $29,502.60.

Decatur, Ill.—The contract for building a sewer in the alley between Main and Water-sts. was awarded to H. Mueller & Co. Dec. 20 at 98 cents per foot.

Kansas City, Kas.—The contract for building 4,600 feet of thirty-two-inch sewer has been awarded to E. O. Parsons at an estimated cost of $17,000.

Scranton, Pa.—The contract for constructing the North Hyde park and Sweetland-st. sewer in West Scranton, was awarded Dec. 19 to Peter F. Mulligan for $1,845.

Ft. Madison, Ia.—The Ft. Madison constructing company was awarded the contract Dec. 2, for constructing 3,000 feet of ten-inch pipe sewer at 15 cents per foot, the city to furnish the pipe.

Omaha, Neb.—The contract for constructing the new Walnut Hill sewer was awarded to John F. Daily at 47 cents per foot, with imported cement, and 45 cents per foot with American cement.

Hartford, Conn.—Michael O'Neill secured the contract for a public sewer in State-st. for $1,558.75 Dec. 4; James Campbell was awarded a contract the same evening for a sewer in Ann-st. for $772.20.

Baltimore, Md.—The contract to furnish cover and drip stones for sewer inlets for 1896 was awarded to W. H. Johnson at 80 cents per square foot for cover, and 50 cents for drip stones. The contract will amount to about $2,500.

Duluth, Minn.—The contract for building a sewer on Twenty-ninth-ave., west from Helm-ave. to Railroad alley, with an outlet in Railroad alley, from Twenty-ninth-st. west to Twenty-eighth west, was awarded to Andrew Swanson for $645.08.

Allegheny, Pa.—Sewer contracts were awarded Dec. 12, as follows: Central-ave., from Wood's run to Grand-ave., W. A. Adams, Pittsburg, $8,405; W. Jefferson-st., from present terminus to Shields alley, Harvey Shaw, $700; Carroll-st., W. J. Dunn, Pittsburg, $251.

Wildwood, N. J.—Bids were received Dec. 10 for a sewer as follows: Lemuel E. Miller, Cape May, $6,461; John D'Arcy, Trenton, $4,866; Thomas J. McGovern, Philadelphia, $4,567; B. F. Sweeten & Son, Camden, N. J., $4,078; Thomas H. Regan & Co., Philadelphia, $3,878; Shoemaker & Milloy, Lansdowne, Pa., $3,397.

Scranton, Pa.—(Special.)—Joseph P. Phillips, city engineer, says that bids were received and read before select council Dec. 4, as follows: Capouse-ave. and Larch-st., approximate estimate of cost $1,424 for 890 lineal feet, 275 lineal feet 12 inches and 615 lineal feet ten-inch pipe, four catch basins and six manholes, average depth twelve feet; Peter F. Mulligan, city, $1,250 complete; Hart & Gibbons, Wilkesbarre, $1.59 per lineal foot; A. H. Coon & Sons, Kingston, $1.68. Hyde Park-ave. and Swetland-st. sewer, ap-

proximate estimate of cost $2,218 for 1,105 lineal feet, 205 feet twenty-inch and 900 feet ten-inch pipe, average depth 10.1 feet, two catch basins and seven manholes; Peter F. Mulligan, $1,845 complete; Hart & Gibbons, $1.93; A. H. Coon & Sons, $1.94.

Greenfield Ind.—(Special.)—W. J. Cleary, city engineers, says that bids were received Dec. 18, as follows: Winnie Fries, ten-inch sewer, 49½ cents; eight-inch, 50 cents; manholes, $30; lampholes, $6. Middletown paving company, ten-inch, 47 cents; eight-inch, 47 cents; manholes, $28; lampholes, $8. James Fry, ten-inch, 64 cents; eight-inch, 64 cents; manholes, $35; lampholes, $5. The contract was awarded to the Middletown paving company.

WATER-WORKS.

Chicago, Ill.—Commissioner Kent hopes to have water flowing through the tunnel by March 1.

Spokane, Wash.—The city council has decided to increase the amount of the water works bond issue to $435,000.

Allegheny, Pa.—The water committee rejected all proposals made by experts Dec. 11 for the purification of the water supply.

Cincinnati, O.—The board of administration will soon take up the question of new water works and go about it in a more practicable way than was done before.

Mt. Clemens, Mich.—G. H. Benzenberg of Milwaukee has been engaged to make estimates on the cost of locating pumping works at the two proposed points for this city.

Topeka, Kas.—Judge Foster issued, Dec. 7, a decree of foreclosure on the Topeka water company property and ordered the sale of the plant at the expiration of six months.

Weedsport, N. Y.—A certificate of incorporation has been filed by the Weedsport water company whose main office will be in Moravia, to supply this village with water.

Crawfordsville, Ind.—The Crawfordsville water and light company was sold Dec. 14 for $50,000 to the Knickerbocker trust company of New York, which held the first mortgage.

Pottsville, Pa.—A certificate of incorporation has been filed by the Sharp Mountain water company which will transact business in this city, and is to exist for a term of fifty years.

Dexter, Me.—Mr. Loring N. Farnam, New Haven, Conn., visited this city Dec. 14 to look into the matter of putting in a system of water works under the charter obtained last winter.

Tacoma, Wash.—The council has adopted the report of the special committee recommending Carbon river and its tributaries, Chenuis river and Canada creek and other streams, for the new sources of water supply.

Duluth, Minn.—A local capitalist has offered the city council to furnish $200,000 in cash to be used in the construction of the new water plant and to take the city's order at 6 per cent. for the sum, the money to be paid as fast as needed as the work of construction progresses.

Salina, Kas.—When the franchise was granted for the water works plant a proviso was inserted in the ordinance allowing the city to purchase the plant at an appraised valuation after the expiration of ten years, which expired two years ago, but the water works company does not care to sell, as the plant makes a profit of $6,200 annually, or about 25 per cent., on the actual investment. The plant can be duplicated, it is stated, for $25,000.

Seattle, Wash.—(Special.)—At a special election held on December 10, 1895, by more than a three-fifths majority vote, it was decided to extend the city water works by adding a gravity supply from Cedar river at a cost not to exceed $1,250,000. Action in this direction has been hastened by developments indicating a purpose to obtain control of the natural water supply sources for private profit. The supply which will be acquired under the plans of the city will afford opportunity of developing power to the extent of 5,000 H. P., and a municipal lighting and power plant will be the natural consequence of the proposed additions. Specifications, plans, forms of proposal and contract are now being prepared by R. H. Thompson, city engineer, and notice will hereafter be given calling for bids.

CONTEMPLATED WORK.

Water works have been favorably voted upon at Sanborn, Ia., and Scranton, Ia.

Lincoln, Neb.—The election held Dec. 7 to vote $20,000 for a water works system was carried.

Silver Lake, N. H.—A company has been organized to construct a water works system.

Jamaica, L. I.—The citizens will meet Jan. 9 to discuss the question of water works construction.

Franklin, Va.—J. P. Gay and J. R. Knight have been appointed a committee on water works construction.

Weimar, Tex.—Plans will probably be prepared and bids asked in January for a water works system. J. C. Kindred, mayor.

Mt. Vernon, Wash.—The proposition to bond for $14,000 for constructing a system of water works won by a very small majority.

Danville, Ill.—The question of new water works will be submitted to vote in the spring. E. E. Boudinot, chairman committee.

Union, S. C.—A water works system is contemplated. T. C. Duncan is chairman of a committee appointed to secure information.

Milford, O.—An election on the water works question is favored, and if it carries the work will be pushed to completion before next summer.

Mt. Joy, Pa.—The clerk of the water committee has been authorized to correspond with manufacturers relative to the purchase of a new pump.

Kansas City, Mo.—Mayor Davis, in a communication to the board of public works, Dec. 13, asked that new water mains be laid on several streets.

Athens, Ga.—A water works system is contemplated. A water works and electric light plant is also wanted for the college, of which J. S. Parker is president.

St. Ansgar, Ia.—The question of water works and electric lights has been favorably considered, but no steps taken to secure them. O. O. Danhowe, chairman.

Wellington, O.—Action has not yet been taken in the proposed construction of water works, although some surveys and estimates have been made. R. N. Goodwin, clerk.

Boonville, Ind.—The water works election Dec. 26 resulted in favor of the project. The town council will now consider plans and specifications and other preliminary steps necessary to inviting bids.

South Glens Falls, N. Y.—Surveys and maps are being made of this village and the Hudson river in this vicinity for the purpose of ascertaining the cost of putting in a system of water works. George Slade, C. E., is making the surveys.

The question of issuing bonds for water works construction will be voted on as follows: Newkirk, Ok. T., Jan. 14; Charlotte, N. C., Feb. 14, J. C. Weddington, mayor; De Ruyter, N. Y., H. D. Preston; Defiance, O., April; Suisin City, Cal., Feb. 1, O. B. Powers, clerk.

Dubois, Pa.—The council has adopted a motion to instruct the water committee and attorney to submit to a vote of the people on the third Tuesday of Februray, 1896, the question of increasing the borough debt for the purpose of putting in a water system for public, domestic and manufacturing purposes.

Glassboro, Pa.—Those who opposed water works a year ago are now in favor of the movement. A petition has been laid before the township committee containing over two-thirds of the voters' signatures. The question of the municipal ownership of the proposed plant, or annexation to the Clayton works, three miles below, has not been decided.

Newark, N. J.—The East Jersey water company contemplates building at once a new pipe line. The capacity of the present line is inadequate for furnishing 50,000,000 gallons, as required by the contract between the company and this city. The capacity is about five millions short of the required amount. The cost to the company, it is estimated, will exceed $500,000, and it will probably take a year to complete the pipe line.

CONTRACTS TO BE LET.

Greenwood, Miss.—Bids are invited until Jan. 6 for constructing water works.

Delphos, O.—The contract for a water works system will probably be let in January. R. H. Gamble, Lima, O., is consulting engineer.

Duluth, Minn.—Sealed proposals will be received until Jan. 13, 1896, for laying the intake pipe, etc. Certified check, $500. M. J. Davis, president.

Brockton, Mass.—Bids are asked until Jan. 10 for furnishing a 5,000,000 gallon pumping engine. E. A. Reynolds, chairman commissioners.

Toledo, O.—Sealed proposals will be received until Jan. 21, 1896, for furnishing 15,000 lineal feet—2,800 tons of thirty-inch cast iron water pipe; fifty-eight tons special castings; five thirty-inch valves; twenty ten-inch; ten eight-inch and thirty six-inch valves. T. R. Cook, superintendent.

Des Plaines, Ill.—Sealed proposals will be received until Jan. 6, 1896, for laying water supply pipes. Certified check, $500. Edward C. Schaefer, village clerk.

Preston, Minn.—(Special.)—Bids will be asked in February for a combined water works and electric light plant. The Iowa engineering company, Clinton, Ia., has been engaged to make plans.

Toronto, Ont., Can.—Tenders are invited until Feb. 15 for supplying and delivering 2,350 feet of steel or cast iron pipe six feet in diameter. Daniel Lamb, chairman committee on works.

Buffalo, N. Y.—Sealed proposals will be received until Jan. 3, 1896, for constructing a new conduit and well for the 30,000,000 gallon engine. Certified check, 50 per cent. R. G. Parsons, secretary B. P. W.

Lockport, Ills.—Sealed proposals will be received until Jan. 6, 1896, for laying a system of water pipe mains, with hydrants, valves, etc. Certified check, $500. F. H. Reed, village clerk; W. S. Shields, engineer, Chicago.

Unionville, Mo.—Sealed proposals are invited until Jan. 10, 1896, for plans and specifications for a water works system and electric light plant, the entire cost of both plants not to exceed $18,000. G. H. Gardner, city clerk.

Cleveland, O.—Sealed proposals will be received until Jan. 18, 1896, for furnishing and delivering such cast iron pipe and special castings as will be needed during 1896. Bond, $5,000. D. E. Wright, director public works.

Mt. Forest, Can.—Plans and specifications for a water works system, with tenders of the cost of the construction of the works from Woodland Springs, will be received until Jan. 10, 1896. Deposit, $5,000. W. G. Scott, chairman.

CONTRACTS AWARDED.

Duquesne, Pa.—The council received twenty-three bids for the erection of the water works system. The lowest bid was $65,000.

Falmouth, Ky.—J. R. Poindexter, Cynthiana, Ky., was awarded the contract for constructing water works in the city for $13,793.20.

Beaver Dam, Wis.—W. H. Wheeler & Co., Beloit, Wis., secured the contract for constructing and maintaining a system of water works in this city.

Tarrytown, N. Y.—The board of water commissioners has awarded the contract for enlarging the water works to Van Vranken & Duel for $27,990.

Alton, Ill.—The contract for water works in Upper Alton was awarded to Morgan & Co. of Chicago. A meeting was held Dec. 20 to take steps to prevent the contract from being carried out.

Atlantic City, N. J.—The city council received twenty-seven bids from New York, Philadelphia and Chicago firms for improvements to the city water system, the estimated cost of which is $175,000.

Middletown, Ind.—The contract for constructing the water works system was awarded to W. S. Wagner of Minneapolis; pumps, J. H. McGowan, Cincinnati; boilers, Chandler & Taylor, Indianapolis; valves, Ludlow valve company; pipe and specials, J. B. Clow & Son.

Miami, Mo.—The council awarded the contract for constructing water works to Delany Bros. of Slater, Mo., for $837.

Galesburg, Ill.—(Special.)—M. J. Blanding, city engineer, says that the contract for laying 240 lineal feet of six-inch water main on Pine-st. has been awerded to Ferry & Andrews at 72 cents per lineal foot, including three hydrants and two six-inch valves. The contract for sinking an artesian well was awarded to H. W. Carter of St. Louis at $2.85 complete. From the surface to the bed rock the diameter is fourteen inches; from bed rock to St. Peter's sandstone, ten inches, and through St. Peter's sandstone, six inches.

BRIDGES.

Oregon, Ill.—The question of the need of an iron bridge across the Rock river has been raised.

Sioux City, Ia.—The Short line bridge will be formally opened in the week beginning Jan. 20.

Providence, R. I.—The new Washington row bridge was completed and opened to the public Dec. 18.

Aurora, Ill.—The question of a new bridge across Fox river at Pearce-st. is being agitated again.

Kemptville, Ont.—Surveys are being made for a swing bridge by G. F. Martin of Smith's Falls, Ont.

Oil City, Pa.—The citizens are about to petition for a new bridge over Oil creek. A. T. Hyde, city engineer.

Superior, Wis.—A survey has been made by Pearl H. Smith for a new bridge over the Amicon river next spring.

Atlanta, Ga.—The contract may be let in January for constructing a bridge over the railway tracks at Jones-ave.

Detroit, Mich.—Keepers & Thacher, this city, will construct the new bridge across the Rouge, between Springswell and Ecorse township.

Louisville, Ky.—The lowest bid received Dec. 11 for a steel bridge over Fern creek was that of the Louisville Bridge & Iron company, $274.

Toledo, O.—The Ohio bridge company, this city, secured the contract for the superstructure of a bridge over the canal in Providence township.

Peoria, Ill.—(Special.)—A. D. Thompson, city engineer, says that a new steel highway bridge will be constructed across the Illinois river next season.

Danville, Va.—Bids will be received until Jan. 6 for the construction of an iron or steel bridge. Address P. B. Farmer, R. A. James or F. A. Miller.

Rochester, N. Y.—The question of constructing a bridge across the Genesee river, between Rush and Wheetland, is being considered by the supervisors.

Goldthwaite, Tex.—The contract for a bridge across the Pecan bayou was awarded to the Flinn-Mayer bridge company of Sherman, Tex., for $3,400.

Montague, Me.—The contract for constructing the Howland bridge was awarded to the Berlin iron bridge company of East Berlin, Conn., for about $45,000.

Marinette, Wis.—City Engineer Shaw has recommended that bids he advertised for constructing either a steel or wooden bridge between this city and Menominee, Mich.

Winona, Minn.—The stone bridge over Rollingstone creek has been completed at a cost of $1,340. The bridge was designed by Fred H. Pickles, city engineer of this city.

Knoxville, Tenn.—The probability of a new bridge being built over the river at the foot of Gay-st., will be determined during the January session of county court.

Carrollton, Ky.—An effort is being made to interest the citizens in a scheme for building a bridge across the Kentucky river. A subscription of $20,000 has been asked.

Youngstown, O.—An iron bridge, sixty feet wide, on a stone foundation, is contemplated across the Youngstown river. The contract will probably be let in the spring.

Mobile, Ala.—The Youngstown bridge company, Youngstown, O., was awarded Nov. 20, the contract for constructing three steel bridge spans and approaches for $5,900.

Annapolis, Md.—Bids will be received until Jan. 7, 1896, for building a fifty-foot bridge over Furnace branch, Glenbournie, A. K. Starlings, clerk board of county commissioners.

Burlington, Kas.—Sealed proposals are invited until Jan. 13, 1896, for building a steel bridge eighty feet long with a twelve-foot roadway in Coffey county. T. N. Bell, county clerk.

Lewisburg, Pa.—A preliminary petition was presented recently to the county commissioners by the citizens of Chillisquaque township for a free bridge between this town and East Lewisburg.

Buffalo, N. Y.—The contract for the superstructure for the new lift bridge over the Buffalo river at Michigan-st., was awarded to the Wisconsin bridge company of Milwaukee, Wis., for $38,700.

Rapid River, Mich.—The Gillette-Herzog manufacturing company of Minneapolis was awarded the contract for the construction of a bridge across Whitefish river, near this town, for $4,490.

Sandy Hill, N. Y.—A petition has been circulated, asking the legislature for a hoist or drawbridge over the canal in place of the Whitehall bridge on N. Main-st. Philip Beaulac is interested.

Wellsville, Mo.—Plans for a combination iron and wood bridge have been prepared by J. J. Douglas. The county court will consider plans and bids for one or more bridges Jan. 6 at Danville, Mo.

Houston, Tex.—The Pennsylvania bridge company, Beaver Falls, Pa., secured the contract for constructing a bridge across Buffalo Bayou at Sheperd's dam, about three miles from this city, Dec. 9, for $2,595.

Rochester, Minn.—(Special.)—W. C. Fraser, city engineer, says that sealed proposals will be received Jan. 7, 1896, for building a steel bridge, 200 feet long and 40 feet wide, across the Zumbro river at Fifth street.

Scranton, Pa.—Mayor Connell has instructed the city engineer to furnish councils with a map showing the land that will be necessary for the erection of the West Lackawanna avenue viaduct, and estimates of the damages that will result to adjacent property.

Kansas City, Mo.—The contract will be let at public outcry Jan. 7 for the building of an iron bridge on tubular iron piers. Deposit, $200. F. J. O'Flaherty.

Whately, Mass.—An iron bridge has been ordered built over Mill river on the South Deerfield road, by the selectment to replace the one which recently gave way.

Xenia, O.—Suit will be brought by this city against the Pan-Handle railway company to compel them to erect a bridge over their tracks at Monroe street to connect with a $5,000 bridge which was placed there by the city.

Hamilton, O.—Sealed proposals will be received until Jan. 7, 1895, for an iron and steel hoist bridge across the Miami and Erie canal at Franklin road in Middletown. Certified check, $500. Frank X. Duerr, County Auditor.

Denver, Col.—The Wrought iron bridge company of Canton, O., was awarded the contract for the construction of the Prowers county bridge, Dec. 20, for $7,200. The Kansas City bridge company secured the Summit county bridge for $2,600.

Chamberlain, S. D.—A bill was introduced in Congress Dec. 6 asking for a charter for the Dakota Pacific bridge company. The company was organized in New York and Amsterdam for the purpose of building a railroad and wagon bridge across the Missouri river near this city.

Detroit, Mich.—It is reported that permission will be asked by the Canada & Michigan bridge and tunnel company for power to build a high level bridge across the Detroit river from Windsor to this city D. C. Mills of New York, James Ross of Courtright, Canada, and several others are interested.

Richmond, Ind.—Drawings have been submitted to the county commissioners illustrating the proposed sight of the new bridge over the Whitewater river at Main street. According to City Civil Engineer Weber's plans the bridge will be 620 feet long with a 32-foot roadway and 7-foot walks on either side.

St. Louis, Mo.—It is an almost assured fact that the Mississippi will be spanned by a new free bridge. The legislative committee, Chairman F. P. Brownell, P. H. Degnan, Gustavus Goetz, P. J. Pauley and Charles Aldrich, have been authorized to at once draft a petition to Mayor Walbridge to submit the question to a vote of the people.

New York City.—The East river bridge commisssion decided Dec. 18 to pay $200,000 for the charter of the East river bridge company. It was decided that the bridge be constructed from a point between South Fifth and South Sixth streets, Brooklyn, to a point near Delancy street, this city, with terminus and approaches north of Grand street.

Topeka, Kas.—The county commissioners have entered into a contract with Keepers & Thacher of Detroit, Mich., for plans for the new Melan bridge. One important feature of the contract provides that Keepers & Thacher shall submit a bid of not more than $135,000 for the construction of the bridge, removing the old bridge and caring for the travel while the new bridge is being built. The plans will hardly be ready before Feb. 1, and the contract will probably be let some time after, so that the work can begin early in the spring.

Indianapolis, Ind.—The bids received Dec 18 for building a bridge over White river at Raymond-st. were returned unopened to the bidders. After examining the county's finances Commissioners Harding and Greer deemed it advisable to defer action until next spring. Twenty-five bids were received. Another site is proposed, one and one-half miles below Raymond-st., and it is hoped that when the question again comes up it will be chosen.

PARKS.

Somerville, Mass.—The purchase by the city of the vacant land at the top of Prospect hill for park purposes is advocated by some.

Springfield, O.—Messrs. John and David L. Snyder, who presented to the city 12,000 acres of land for park purposes, are about to add to the gift.

Omaha, Neb.—The proposition to open a boulevard over Saddle creek, from Forty-seventh and Hamilton-st., three miles south, is met with opposition at present.

Winnipeg, Man.—Alderman Ross has in contemplation a scheme for paving with asphalt and boulevarding a handsome drive extending from Kennedy-st. south to Assiniborne, east to Donald, the whole length of Donald-st. to Portage-ave. If feasible, the contracts will be let early in the spring.

Chicago, Ill.—Commissioner Downey, whom the West park board has delegated to circulate petitions for boulevarding W. Jackson-st., from Halstead-st. to the river, reported Dec. 12 that he had secured more than 500 feet frontage in favor of the boulevard proposition. Residents of Lake-ave. want that thoroughfare made into a boulevard. Their idea is to have it extend from Fifty-first to Sixteenth-st., connect with Michigan and Drexel boulevards and run to Jackson park, making a boulevard system ten miles long.

Milwaukee, Wis.—City Engineer Benzenberg, Alderman James Bryden and Park Superintendent Pettigrew have decided to construct a drive on the same plan, though less expensive, of the lake drive at Lincoln park, Chicago, and visited that city Dec. 17 for the purpose of investigation. The work will begin as soon as possible. The first step toward it will be the building of a bridge across the tracks of the Northwestern road at a point between Mason and Biddle-sts., and then a large bulkhead and breakwater will be constructed outside the water line so that the large amount of dumpings that are now disposed of with difficulty may be deposited there.

San Francisco, Cal.—The business men and property-owners are the main instigators, according to report, in a scheme for a boulevard commencing at Grand and Palace hotels to the Presidio, through Montgomery or Kearney-sts. to Montgomery-ave. A. B. Spreckles, chairman of the street improvement committee of the board of supervisors, will go over the proposed route of the boulevard in order to see if the plan is feasible.

Burlington, Ia.—Park Commissioner Crapo has received from Earnshaw & Punshon, landscape engineers at Cincinnati, an elaborate plan and report for laying out and improving Crapo park.

Santa Barbara, Cal.—A continuation of the present boulevard along the shore of the channel, as far as Booth's point, has been decided upon. When completed the road, together with the mountain boulevard, will give a circular drive east of the city of twelve miles, combining mountain and shore.

MUNICIPAL BONDS.

Norwood, O.—W. E. Wichgar, clerk, invites bids until Jan. 6 for the purchase of $2,924.04 of 6 per cent. street improvement bonds.

Saginaw, Mich.—Lamprecht Bros. & Co. of Cleveland were the successful bidders for the purchase of the $12,500 street improvement bonds.

Miles City, Mont.—Bids are invited until Jan. 15 for the purchase of $17,000 of 6 per cent. electric light and water bonds. S. Gordon, clerk.

Carthage, O.—Sealed proposals will be received until Jan. 4 for the purchase of $620.96 of 6 per cent. sidewalk bonds. Lewis Hall, clerk.

South Bend, Ind.—W. A. Rutherford, city treasurer, invites sealed proposals until Jan. 15 for the purchase of $25,000 of 4 per cent. water bonds.

STREET SPRINKLING.

Pawtucket, R. I.—(Special.)—Alden W. Sibley, city clerk, says that no purchase has yet been made of a street sprinkler, nor has the board of aldermen yet investigated the system of electric street springling, as authorized.

GARBAGE DISPOSAL.

Glen Ridge, N. J.—Messrs. Brewer & Nevin have been appointed a committee to report on the disposal of garbage.

Los Angeles, Cal.—In his annual report, the health officer suggests that the city build a crematory of its own and collect the garbage now handled by contractors.

Columbus, O.—The contract for garbage disposal was awarded to Charles and George Geigele for ten years for $15,800. The plant will probably be ready for use in April.

Reading, Pa.—Several city officials, including Edward Chamberlain, city engineer, and H. H. Hammer, city clerk, visited Pittsburg recently to get information relating to garbage disposal.

Dayton, O.—Bids will be received until Jan. 2 for the construction of a garbage disposal plant to destroy all kinds of garbage and city refuse for a city of 110,000 population. Check, $1,000. C. A. Herbig, city comptroller.

Peoria, Ill.—(Special.)—A. D. Thompson, city engineer, says that the city contemplates the construction of a garbage crematory. A report has been submitted recommending the adoption of cremation and the purchase of a Rider, Eagle or a Smith crematory.

Bridgeport, Conn.—The terms of the contract by which garbage is to be delivered by the city to the utilization company provide that no person can transport garbage through the city streets without having a license from the board of health.

Oakland, Cal.—The odorless crematory company, consisting of Louis Shaffer, Theodore Swift, C. W. Lent and J. W. Swift, is erecting a crematory in order that representatives from other cities may see it in operation. The company will make an offer to this city to destroy garbage at a reasonable price.

Lancaster, Pa.—A proposition has been submitted by Dr. L. M. Davis, who offers to erect a garbage crematory and collect and cremate all the garbage of the city for a term of years, the city to have the privilege of purchasing the plant at its actual cost at the end of five years. Popular opinion favors garbage cremation.

New York City.—Only one bid was received Dec. 10 for final disposition of street collections, garbage and ashes by other means than dumping them in the sea, the secretary of war having ordered this practice discontinued after April 1. Zeph F. McGill offered to dispose of it for five years for $306,000 a year, but his bid was defeated in that it offered but one surety, while two sureties are required. The conditions of the proposed work are said to be too severe; consequently contractors refrained from bidding.

STREET LIGHTING.

Reading, Pa.—A report is being prepared for the councils on a municipal electric light plant.

New Rochester, N. Y.—A committee has been appointed to consider the feasibility of constructing an electric light plant.

Rockford, Ill.—An electric light plant in connection with the county hospital is being considered. E. W. Brown, mayor.

Jamaica (L. I.), N. Y.—A meeting will be held by the citizens Jan. 9 to discuss the question of erecting an electric light plant.

Carrollton, Ill.—Bids are invited until Jan. 14 for lighting the streets with electricity for a term of years. Ornan Pierson, mayor.

Grinnell, Ia.—The question of an electric light franchise will probably be voted upon soon by the people. No plans have yet been adopted. F. E. Hull.

Mauch Chunk, Pa.—A fifteen-thousand-dollar electric light plant is contemplated.

St. Mary's, O.—An electric light plant is said to be contemplated.

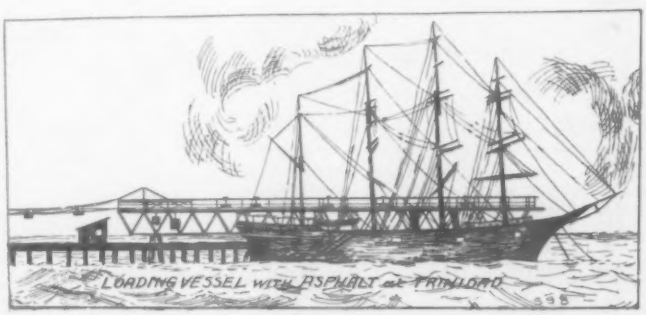
Unionville, Mo.—Plans and specifications are invited until Jan. 10 for an electric light plant and water works system to cost about $18,000. G. H. Gardner, city clerk.

Spokane, Wash.—The purchase or the construction of an electric light plant in connection with the water works has been recommended to the council by the light commissioners.

Union, S. C.—The residents have presented a petition to the council for an election to vote on the question of issuing $40,000 in bonds for an electric light plant and water works. T. C. Duncan, chairman of committee.

TRINIDAD LAKE ASPHALT.

The Standard Material for Pavements—Where it Comes From—Cities Should Insist on Having it Because it is the Best.

Maps of the American hemisphere, such as the accompanying outline, have been in great demand during the last month, as a means of enabling people to better understand what territory is involved in the Venezuelan question. In locating Venezuela the eye almost unavoidably encounters the island of Trinidad, a strange and interesting spot, the name of which has become familiar to the people of the United States as the source of supply for the superior quality of asphalt, known as Trinidad Lake asphalt, used in making the best pavements of this kind in American cities. Asphalts and bitumens have been found in many places, but none equal for paving purposes to that obtained from the remarkable asphalt lake of Trinidad island.

Here the wonderful processes of nature have produced a material of qualities so subtle in their superiority that man's ingenuity has failed to find anything fully equal to it. It is because of this superiority that Trinidad Lake asphalt has become the standard asphalt for street paving. Its use is required wherever the asphalt known to be the best is wanted. It is the only asphalt that has stood the test of eighteen years' use on the streets of American cities. Because of its known superiority, its durability and maintenance in good condition is guaranteed. Not only is its high quality constant, when obtained from the lake, but the supply is practically inexhaustible. There is no good reason why every city should not have it—they should insist on having it and be sure that it is Trinidad lake asphalt that they are getting. It is the best; it is the cheapest because it is the best.